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AUTHOR Torrance, E. Paul; And Others
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ABSTRACT

This task group report is one of a series prepared by eminent psychologists who have served as consultants in the U.S. Office of Education-sponsored grant study to conduct a Critical Appraisal of the Personality-Emotion-motivation Domain. In order to achieve the goal of identifying important problems and areas for new research and methodological issues related to them, the task force followed an approach in which leading investigators in specialized areas were enlisted as members of task groups and asked to reflect on their current knowledge of ongoing research and to identify the research needs in their respective areas. The articles in this report include: (1) Creativity: An Overview (Torrance); (2) Conceptualization of Creativity: Relations to Intelligence and Personality Factors (Gowan); (3) Creative Process (Phillips); (4) Characteristics of the Creative Product (Davis); (5) Characteristics of the Creative Situation-Short and Long Term Situational Factors Contributing to Creative Performance (Aliotti); and (6) The Assessment of Creativity (Treffinger). (Author)

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Task Group Members

E. Paul Torrance, Chairman, The University of Georgia

John C. Gowan, San Fernando Valley State University

Victor K. Phillips, The University of Georgia

D. Jack Davis, North Texas State University

Nicholas C. Aliotti, State University of New York at Albany

Donald J. Treffinger, Kansas University

NEEDED RESEARCH ON CREATIVITY
A SPECIAL REPORT OF THE USOE-SPONSORED GRANT STUDY: CRITICAL APPRAISAL OF RESEARCH IN THE PERSONALITY-EMOTIONS-MOTIVATION DOMAIN

Prepared by Task Group 2800 - Creativity
E. Paul Torrance, Chairman, John C. Gowan,
Victor K. Phillips, D. Jack Davis,
Nicholas C. Aliotti,
and Donald J. Treffinger

Under the Editorship of S. B. Sells
Principal Investigator
Grant No. OEG 0-70-2665-(508)

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FOREWORD

The task group report presented in the following pages is one of a series prepared by eminent psychologists who have served as consultants in the U. S. Office of Education sponsored grant study to conduct a Critical Appraisal of the Personality-Emotions-Motivation Domain. The study was planned with the advice of an advisory committee including Professors Raymond B. Cattell and J. McV. Hunt (University of Illinois), Donald W. MacKinnon (University of California, Berkeley), Warren T. Norman (University of Michigan), and Dr. Robert H. Beezer (USOE) and follows a topical outline included as an appendix to the present report. In order to achieve the goal of identifying important problems and areas for new research and methodological issues related to them, an approach was followed in which leading investigators in specialized areas were enlisted as members of task groups and asked to reflect on their current knowledge of ongoing research and to identify the research needs in their respective areas. The general plan is to publish these reports as a collection with integration contributed by the editors. It is hoped that these reports will prove to be valuable to research scientists and administrators.

S. B. Sells, Ph.D.
Principal Investigator

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I. CREATIVITY: AN OVERVIEW

E. Paul Torrance
The University of Georgia

Introduction

In spite of very spirited attacks during the 1960s by such critics as Sir Cyril Burt (1962), Robert L. Thorndike (1963), Ernest Newland (1963), Quinn McNemar (1964), Philip C. Vernon (1964), Michael Wallach and Nathan Kogan (1965), and others, creativity research has continued into the 1970s and remained vigorous. Early in 1973, a new outburst of attacks came from educators such as Robert Ebel, Robert M. W. Travers, and George J. Mouly and it remains to be seen how well research in this area will survive and how much influence it will have upon educational practice.

At this time, several indexes of vigor and influence can be cited. This writer has just compiled a bibliography of reports, dissertations, and published articles on the Torrance Tests of Creative Thinking (1966) consisting of 625 items since 1959. The distributions by two year periods are as follows:

1959-60	2
1961-62	34
1963-64	88
1965-66	106
1967-78	112
1969-70	132
1971-72	121

At the time the bibliography was compiled, 30 publications had been identified in 1973.

Another index of the influence of creativity research in education may be obtained by comparing the amount of space devoted to the topic in leading educational psychology textbooks in use in 1950 at the time J. P. Guilford made his now famous presidential address before the American Psychological Association calling for more research in this problem area and educational psychology textbooks in use in 1973. Nine leading textbooks in use in 1950 and 9 leading textbooks in use in 1973 were analyzed. The mean number of pages devoted to creativity in the 1950 textbooks was 10.6 pages compared to 27.8 pages in the 1973 textbooks. The difference in means is statistically significant at the .02 level (t-ratio = 2.81).

Still another index of the influence of creativity research in education may be obtained by comparing the space devoted to the problem area in magazines for classroom teachers. The Instructor magazine was selected because it has the largest circulation among such periodicals and the issues for 1950 and 1972 were analyzed. The 11 issues for 1950 contained 33 items dealing with applications of creativity research while the 10 issues for 1972 contained 101 such items. The difference in means is statistically significant at the .001 level (t-ratio = 3.94).

It is difficult if not impossible to obtain a similar index of the influence of creativity research on the textbooks used in

elementary and secondary schools. Examination of a large number of such textbooks used in 1950 and 1973 leave little question but that substantial changes have occurred in the direction of more creative activities, more models of creative problem solving, and more open-ended questions that cause children to examine information in different and in imaginative ways. A good prototype is provided by the Ginn Reading 360 Program. Deliberate efforts were made to use research results to build into this program in a thoroughgoing way features that will facilitate creative functioning. Some of the stories and poems, illustrations, and graphic elements of the books themselves motivate readers to think creatively. The teachers' editions provide a large variety of suggestions for such practice. In addition, exercises in the skills practice books are designed to develop important skills in creative thinking. Guidance provided by research included developmental information about the hierarchy of skills involved in creative thinking and information about teaching methods and strategies before, during, and after a lesson. Field tests using a variety of evidence and formal evaluations have been quite positive. The following quotation from a report of one of the field tests is illustrative:

> These are only a few of the many activities that the Reading 360 Program initiated for these first graders. The children became very enthusiastic about securing information for so many things that they were taking 4-6 library books per week from the school library plus those they found in the public library. This reading program never ended at any one time period. Instead, it acted as a springboard for

> daily, weekly, and yearly class activities in all subject areas (Plooster, 1972, p. 5)

The evidence indicates that children who are creatively involved in their reading will be motivated to "find out" and as a consequence will read books, ask questions, conduct experiments, and the like. This is quite the opposite of what Travers (1973), Wallach (1973) and other critics say will occur with the use of creative activities in the classroom. Wallach (1973) ridicules efforts in the direction of a more creative kind of education and accuses creativity researchers in education of having a "professional deformation characteristic. . . toward viewing alternative pedagogical strategies and commitments, such as to 'creative' or 'open classrooms' ...as deeply important topics fit for endless debate and research." He continues, "With documents such as the Coleman Report in hand, however, we should know by now that many of these issues are luxuries with relatively little consequence for children's learning. . . And these children don't need to read "creatively," they just need to be able to read" (p. 164). Travers is equally sarcastic when he writes, "The task of being creative is far more than that suggested by educational programs that involve little more than training individuals to think up clever ideas in quantity" (1973, p. 183). These are, of course, examples of the misconceptions disseminated by critics such as Travers and Wallach who reject as superficial controlled experiments and as colorful episodes, case study, and historical data.

There seems to be little doubt but that the creativity research of the 1960s is having considerable influence in education in the 1970s. However, let us review the status of knowledge in this problem area as revealed by the task force papers.

Conceptualization of Creativity

"Creativity" is still a new concept, recently attributed to the personality of man. The word "creativity" is almost impossible to find in an English dictionary more than a decade old. It appears only in the most recent French dictionary and still does not appear in the dictionaries of many of the world's leading languages.

Some writers view creativity as an everyday phenomenon, occurring whenever a person solves a problem for which he had no previously learned solution. Others would like to reserve the term for rare kinds of behavior that result in scientific and artistic breakthroughs. Gowan in his review of the conceptualization problem identified two kinds of creativity -- a rational, pragmatic kind and a psychedelic kind. Irving A. Taylor (1959) has conceptualized five levels of creativity as follows: expressive creativity, productive creativity, inventive creativity, innovative creativity, and emergenative creativity. Rhodes (1961) has conceptualized four aspects of creativity: the creative person, the creative process, the creative product, and the creative press. This task force report has been organized essentially

along the lines of this conceptualization, except that the creative person and the creative process have been more or less combined. However, as Gowan suggests in his task force paper, at this stage of development in this problem area no clues or theories should be ignored.

Creative Process

Phillips in his task force paper provides in historical perspective an analysis of the creative process in terms of psychodynamic, fulfillment, cognitive-psychometric, and associative approaches. Each of these approaches have made important contributions to our understanding of both the creative person and the creative process. Phillips maintains that in the main, psychodynamic proponents of the creative process view the creative individual as a closed energy system. There is also the pervading theme among psychodynamicists that conflict (surface or primary) is concomitant to creative activity. Proponents of this approach make use of clinical protocols, profiles, and patterns of observed behavior. Out of these clinical observations we begin to see the creative process not as an all-or-none function, but as an incremental, gradual, and almost unpredictable change through which the creative person produces.

Of somewhat more recent origin in the literature are concepts of the creative process based upon man's potential for fulfillment. Again, most of the proponents of this point of view have histories of extensive therapeutic experience and the data

on which their conclusions are based are derived from private interactions, not quantitative evidence. As Phillips points out, each contributor believes that the creative process may be set in motion, enacted, or energized in various time spans. For some persons, a creative process may require years in which the process is an ongoing sequence. For others, a peak experience may last only a few seconds. Thus, the creative process for the fulfillment advocate may be both incremental and lengthy, or as an all-or-none event. The central concept is that creative thinking evolves out of human growth and vice versa.

As Phillips points out, forerunners of contemporary cognitive and psychometric interpretations of the creative process are found in philosophical, semi-experimental, and measurement essays written more than 40 years ago. A variety of psychometric approaches were developed during the early 1900s and Phillips traces these quite carefully. By 1950 the contemporary cognitive and psychometric study of the creative process was firmly established. Guilford (1950) had identified nine factors of creative thinking which he believed overlap with an extends beyond the domain of traditional intellectual functioning. He hypothesized that the creative process reflects sensitivity to problems, ideational fluency, flexibility of set, ideational novelty, synthesizing ability, analyzing ability, redefining ability, span of ideational structure, and evaluative ability. Later, he (Guilford, 1959) identified the four divergent thinking abilities fluency, flexibility, originality, and elaboration.

He continued his factor analytic studies and finally (1966) offered his model of the creative thinking process. At the present time, it is perhaps one of the most elaborate and useful models of the creative process, at least insofar as educators are concerned.

Phillips concludes that the cognitive and psychometric investigators agree that the creative process is a universal phenomenon. Regardless of the form of the psychometric data, the accumulated data indicate enormous complexity. Phillips concludes that the psychometric approach has brought no conclusive answer concerning the all-or-none nature of the creative process. The cognitive and psychometric interpretation views the complexity of the creative process as reflecting gradual, varied, and, at times, unpredictable solutions. What does emerge with relative predictability is an agreement upon the basic model of creative functioning. Though various authors have altered, elaborated, or appended additional stages, most cognitive and psychometric investigators accepted the basic four-stage model of Wallas (1926).

Several interpretations of the creative process have developed from stimulus-response theory and have generally been referred to as associative theories. Beneath the stimulus-response approaches to creative thinking is the assumption that responses are arranged in a pyramidal hierarchy. Responses closest to behavioral expression and highest in probability of occurrence are considered commonplace, unoriginal, or non-creative. Responses with the least likelihood of appearance are

equated with originality, novel thinking, or creativity. The associationist, however, have actually done very little theorizing about the nature of the creative process. Consequently, a model of the creative process in terms of sequential stages has not been postulated by them. What we have is mainly response probability and an emphasis upon laboratory evidence in terms of pre-specified responses and environmental control.

Characteristics of Creative Product

Davis in his task force paper defines the creative product as the concrete or tangible evidence of the internal process of creative thinking. While it is at best only an indication of the creative process, it is generally the best evidence of that internal action or process. Davis points out that characteristics of creative products such as originality, uniqueness, elaboration, and the like have generally been dealt with on a quantitative basis only. An equally important dimension of creative products is their qualitative aspects. Davis attempts to explore the qualities or characteristics of creative products as they relate to educational practice through the review of relevant research, an identification of research needed for advances in this problem area, a discussion of theoretical and methodological issues involved, and a discussion of the expected contributions which the needed research could make to knowledge and practice.

Davis believes that if we could accomplish the necessary tasks for describing the characteristics of creative products

that we could make genuine advances in developing meaningful curriculum and instructional sequences for the development of creative thinking among leaders of all ages. He also concludes that the need for well-developed and tested instructional materials is one of the most pressing needs of education today, particularly materials that lead to individualized learning. With such materials, learning becomes an on-going process of the individual both in and out of school. Davis contends that these materials must be based upon descriptive research and that to develop more instructional materials without a better research base may be an exercise in futility.

Characteristics of the Creative Situation

In his task force paper Aliotti considers the creative situation as the simultaneous interplay between process and press and its resultant impact on the creative performance of the creative person. He draws upon two kinds of research evidence: retrospective and current accounts of the creative behavior of individuals judged to be highly creative by some appropriate social criteria and empirical investigations conducted in field or laboratory settings in which creative performance is operationally defined and variables effecting this performance are considered. He also examines both short and long term studies.

Issues concerning what constitutes a suitable environment for creativity has led to much controversy. Some investigators

have concluded that creativity is an individually stable characteristic that is systematically sensitive to environmental circumstances, while others contend that creative abilities perish under the prolonged stress of unfavorable circumstances. A few studies of the heritability of creative ability have also begun to appear. A recent study by Pezzulo, Thorsen, and Madaus (1972) found no evidence of hereditary variation in either the figural or verbal forms of the TTCT. Their subjects were 37 pairs of fraternal and 28 pairs of identical twins carefully tested. These investigators found that short term memory (Jensen's Level I abilities) has only a moderate index of heritability, .54; the general intellective factor (Jensen's Level II abilities) has a relatively high index of heritability, .85. The heritability index for the figural and verbal measures of the TTCT approached zero. Another twin study by Richmond (1968) similarly found no evidence of heritability for the abilities assessed by the TTCT. Davenport (1967), using the Getzels and Jackson (1962) measures, concluded that the indications were so weak that he concluded that there was a wide margin in which experience could influence the creative thinking abilities.

An important implication of the finding that creative abilities are not heritable is that educators can expect to be able to do more to modify tests. Thus, educational programs that build competencies in creative thinking and build upon the creative positives of disadvantaged children are likely to be

more successful than are those programs that seek to improve intelligence and compensate for deficiencies in this area.

There are, of course, strong indications that many of the influences in disadvantaged groups encourage creative behavior (Torrance, 1972c). The work of Susan Houston (1973) supports this conclusion. Houston has identified a number of reasons why poor black children customarily get lower scores than white children do on scholastic and verbal-intelligence measures. She maintains that their creativity actually interferes with their success on such tests. In her studies of poor black children in the South who lacked material playthings, Houston found that they engaged in constant language play and verbal contests. They placed high value on creativity and giftedness and Houston rates the stories they told her as highly imaginative. She also found that the poor black children interacted more with one another and developed skills in group interaction which far excelled those of other groups of children of the same age. They also supported or encouraged one another more.

Thus far, the findings concerning the lack of heritability of creative abilities and the lack of racial and socioeconomic bias have stimulated no visible enthusiasm. This is in spite of the potency of the implications of these findings and in spite of the great attention that has been given to the Jensen debate, the Coleman Report (Coleman et al., 1966) and the Jencks Report (Jencks et al., 1972). In fact, these findings are particularly relevant to some of the criticisms of critics of the Jencks

Report, particularly the black critics (Edmonds et al., 1973). These black critics maintain that the school environment has been culturally responsive to the affluent and is actually anti-poor. Further, they assert that "compensatory education doesn't work because it doesn't make the school responsible for teaching in the ways that children are prepared to learn" (p. 81). They argue that people vary in their cognitive styles and "that until schools learn to recognize this and plan different ways of teaching the same requisite skills to all children, they will not come close to providing equality of educational opportunity" (p. 83).

Although there have been some brilliant examples of successes with programs that build upon the creative positives of disadvantaged children (Clary, 1970; Shepherd, 1972; Witt, 1971), little enthusiasm has been generated for them. From George Witt's long-range experiment, for example, we know that it is possible to develop high levels of both academic achievement and creative achievement among black, disadvantaged children identified as gifted solely on the basis of the TTCT. All that it took was to give them a chance to build upon their exceptional creative abilities. Practically all of these children selected in 1965 at the time they were in the second and third grades have distinguished themselves in one or more of the creative arts. Some of them, however, have also shown brilliant promise in the sciences and at the junior high school level most of them are succeeding in first-rate private schools in New England.

Aliotti's review of short and long term situational factors gives considerable credibility to research findings such as those of Pezzullo, Thorsen, and Madaus concerning the heritability of creative abilities and helps us understand such findings. These results provide many clues concerning the creation of situations that facilitate or inhibit creative behavior. Aliotti identifies the deficiencies of existing research and makes provocative suggestions concerning the additional research needed by educators in providing more favorable conditions for creative growth and functioning.

Assessment of Creativity

Since measurement of a phenomenon makes possible research breakthroughs not otherwise possible, the development of procedures for assessing creativity is enormously important. Treffinger in his task force paper points out that although the volume of research concerning the assessment of creativity has increased, many difficult problems remain unsolved. In this paper Treffinger considers problems of validity, reliability, and usability. Of all of these concerns, he considers validity the most important, urgent, and complex.

Treffinger reviews issues and research concerning content, criterion-related, and construct validity. Regarding the entire validity area Treffinger summarizes his conclusions as follows:

1. There is a substantial need for extensive theoretical work, as well as for synthesis, integration, and evaluation of the research literature.

2. Progress in developing adequate operational definitions of creativity depends greatly on progress in developing adequate conceptual definitions.

3. There is a need for extensive studies of new, more adequate external criteria for the validation of creativity measures, as well as for inquiry into the validity and reliability of existing criteria.

4. There is a need for multivariate methods to be employed in correlational studies of creative talent.

5. There are needs for longitudinal studies, well-controlled experimental studies, and for developmental and cross-cultural studies.

The latter area has been of particular concern to this writer for the past 15 years and it seems appropriate to comment on the problem of longitudinal studies of predictive validity. A major criticism of creativity tests, including the Torrance Tests of Creative Thinking, is that there is no evidence of a link between performance on test tasks and real-life creative achievements.

Recently the writer (Torrance, 1972a) reviewed 15 predictive validity studies of the TTCT that seem to link test performance with real-life behavior. In a long-range predictive validity study involving high school students tested in 1959 and followed up in 1971, a canonical correlation of .51 was obtained for the combined scores on the creativity test battery to predict the combined creative achievement criteria in the total sample of 236. For men, the canonical correlation coefficient was .59 and

for women, .46. The following additional findings provide encouraging support (Torrance, 1972b):

1. The class of 1960 was followed up both in 1966 and in 1971 and there was a consistent trend for the validity coefficients to increase from 1966 to 1971. Using the measures of Fluency, Flexibility, Originality, and Elaboration and measures of Quantity and Quality of Creative Achievements and Creative Motivation, the mean validity coefficients was .40 for 46 subjects in 1966 and .51 for 52 subjects in 1971.

2. The present and projected occupations of 252 respondents were classified as conventional or unconventional according to criteria developed by Getzels and Jackson (1962). Using a median split within grade and sex on the original population, 113 subjects were classified as high creatives and 138 as low creatives. Sixty-two or 55 percent of the high creatives and 13 or 9 percent of the low creatives were in unconventional occupations in 1971. When projected occupations or future aspirations were classified, 71 percent of the high creatives and 32 percent of the low creatives chose unconventional occupations.

3. Creative achievements in writing were most easily predicted, followed by creative achievements in science and medicine and in leadership, perhaps because the criteria in these areas are clearer and more obvious than in such fields as business, music, art, and the like.

4. Almost twice as many of the high creatives as the low creatives reported three peak creative achievements as requested

while three times as many of the low creatives as the high creatives described no peak achievements.

5. Significantly more of the high creatives than the low creatives reported peak achievements in the areas of writing, style of teaching, research, musical composition and performance, human relations and leadership, and medical discovery.

6. The low creatives tended to report as peak achievements what appear to be "cop out" or "drop out" experiences unaccompanied by constructive action, while many of the high creatives reported withdrawal experiences either for periods of renewal or for creating a more humane style of life.

One must ask what are reasonable and acceptable standards of validity for tests of creative thinking ability. Some critics (Crockenberg, 1972; Baird, 1972) have stated that the problem is not a lack of validity data on the TTCT but that these data are weak. When confronted by the fact that creative functioning involves a variety of phenomena which occur simultaneously and interact with one another, how much weight should we expect measures of general creative abilities to carry? Research evidence indicates that the motivation of the subject, his early life experiences, the immediate and long range rewards, the richness of the environment, and other factors are all important enough to make a difference in creative functioning and furthermore that these phenomena interact with one another.

When Torrance and his associates found that the women in the long-range prediction study were less predictable than the

men, they tried to obtain responses to the Alpha Biographical Inventory for as many of the women respondents as possible. With a sample of 45 of these women, they (Torrance, Bruch, & Morse, 1973) combined the creativity score derived in 1959 (which did not include a measure of originality). A canonical correlation of .60 resulted. The coefficients of correlation between the Alpha Biographical Creativity Scale and the criteria of creative achievement are .38, .39, and .37; the mean coefficients of correlation between the Alpha Biographical Score and the creative ability measures is .15.

Treffinger identified the following problems concerning problems of reliability of creativity tests:

1. Studies are needed which investigate new methods of determining the accuracy or reliability of measures of creativity, with emphasis on the specification of "error" components.

2. In employing traditional stability indices, attention must be given to determining the extent to which creativity should be expected to be a stable trait, in identifying appropriate intervals for assessing stability, and for assessing systematically the influence of motivation, moods, and other situational variables on reliability of test scores.

3. In considering the utilization of alternate forms or internal consistency indexes of reliability, attention must be given to the problems involved in selection and use of subtests from larger batteries. It must be recognized that tasks in creativity tests may not be discrete "items," and that scores

derived from various tasks may neither be additive, nor meet many fundamental assumptions involved in the traditional determination of reliability indices.

Usability

1. Research must be addressed to developing a systematic theoretical and empirical understanding of the effects of variations in test administration procedures and conditions (including directions, testing environment, working time, and response modes.)

2. Problems relating to test scoring are very important in the measurement of creativity. In addition to research on the comparability of scores derived from different tasks and different methods of testing, studies should also be conducted which investigate new methods and criteria for scoring (particularly for originality and imagination).

3. Problems of the validity and reliability of scorers are extremely important, and all research employing creativity measures should provide full information concerning inter-scorer correlations, as well as comparison of means and variances among scorers and between scorers and test norms.

4. Creativity measures which involve normative scoring procedures must be accompanied by extensive supporting data concerning the norm groups employed and the tasks involved.

Treffinger cautions that these problems are complex and may not be solved very speedily. These problems must be

recognized, however, and they must be considered in interpreting research involving the assessment of creative behavior. Support of research concerning these problems is important because many potential breakthroughs in the problem area are not possible until they are solved.

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II. CONCEPTUALIZATION OF CREATIVITY: RELATIONS TO INTELLIGENCE AND PERSONALITY FACTORS

John Curtis Gowan
San Fernando Valley State College
Northridge, California

THE LITERATURE OF CREATIVITY*

Of all the powers of man, that of creativity seems unique. The generally accepted custom among the ancients was to ascribe divine origin, inspiration or direction to any great creative work so that the poet became the prophet. Even the aspects of initiation and selection, which are universally found in creative function, appear somewhat mysterious, and many of our greater artists and scientists seem to receive inspiration rather than to develop it.

Because creativity is a word which has recently been taken over by psychology from religion, it is almost impossible to discover it in a dictionary more than a decade old. It is still a new concept, recently attributed to the personality of man, and still to some fraught with mystical connotations. For this reason, care should be taken in defining it and in distinguishing it from other mental functions, as well as to note its possible varieties.

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*This section has been abstracted from pp. 5-7 of Gowan, J. C., The Development of the Creative Individual, Copyright, 1972 by Robert Knapp, San Diego, Cal. Used by permission.

Hallman (1963, pp. 18-19) gave a comprehensive definition:

> ... the creative act can be analyzed into five major components: (1) it is a whole act, a unitary instance of behavior; (2) it terminates in the production of objects or of forms of living which are distinctive; (3) it evolves out of certain mental processes; (4) it co-varies with specific personality transformations, and (5) it occurs within a particular kind of environment. A demonstration of the necessary features of each of these factors can employ both descriptive and logical procedures; it can refer to the relevance of empirical evidence, and can infer what grounds are logically necessary in order to explain certain facts.[1]

Creativity, like leadership, is better defined in terms of interactive process than in terms of trait theory. The creative process in superior adults usually results in creative and useful products. Hence, the creativity of such adults is judged in terms of quantity and quality of patents, theories, books, works of art or music and scientific hypotheses. In children, however, where the product may be original with the child but cannot be original with the culture, assessment of creativity usually depends on nominations of "which child had the most wild or silly ideas" to the more conventional Guilford (1967) or Torrance tests (1966) of divergent thinking on the child's part. It should be noted here that some researchers have pointed out the fact that there is as yet no proof that this kind of "creativity" on the part of the child will result in the more demonstrable creative production on the part of the adult. In

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[1]Hallman, R. J. The necessary and sufficient conditions of creativity. Journal of Humanistic Psychology, 1963, 3.

addition, Guilford in particular objects to the term "creativity" as a confusing stereotype of many kinds of ability found in the structure of intellect model and prefers to regard it only as "productive thinking."

Another way of looking at the issues is to analyze the personality correlates or the environmental background which has produced creative adults. This is the method taken by many researchers; notably that of the Institute of Personality Assessment and Research (IPAR) at Berkeley, the biographical of Taylor (MacKinnon, 1964) and the personality psychometrics of Cattell as seen on the Sixteen Personality Factor Questionnaire (Cattell, 1968). These methods yield clear results, indicating a particular kind of individual: intelligent, original, independent, open, intuitive, aesthetically sensitive, highly energetic, dominating, possessing a sense of humor and a sense of destiny, and at home with ambiguity and complexity.

Finally, two polar beliefs must be considered. The first is that creative problem solving is a mundane affair, such as knowing how to turn on the lights in a dark room because one knows where the switch is. This, the Osborn-Buffalo view (Osborn, 1963; Parnes, 1967), states that the techniques of creative problem solving can be taught to anyone as a rational and pragmatic affair. The other or psychedelic view holds that creativity is a dawning of the psychedelic powers of man which can transform him from a rational being into a super-rational one through the use of psychedelia, hypnosis, religious or

meditational exercises, drugs, mysticism, and what have you. It is as far out as the other is conventional.

In this early analysis of creativity, no clues or theories should be neglected. If creativity were an easy matter, it would have been solved before now. In another source (Gowan, 1972) the available literature is organized into five sections for analysis in terms of a rational-psychedelic continuum.

a. Cognitive, rational and semantic: problem-solving views of the Buffalo School, the Guilford structure of intellect, and others (Parnes, 1967; Guilford, 1967).
b. Personality and environmental: child-rearing practices personality correlates, especially originality, energy and high self-concept (Erikson, 1963).
c. Mental health: Rogerian (1959), Maslovian (1954, 1959), self-actualization, openness, etc.
d. Freudian and neo-Freudian: psychoanalytic, oedipal, pleasure, and pre-conscious (Kris, 1952; Kubie, 1958).
e. Psychedelic: existential, nonrational, cosmic consciousness, and psychedelic (Krippner, 1968).

The analysis of needed research and issues involved are based on an analysis of this literature.

NEEDED RESEARCH ON RELATIONS OF CREATIVITY TO INTELLIGENCE AND PERSONALITY FACTORS

1. Creativity seems related to both cognitive and affective factors of personality (Hallman, 1963). What kind of a

variable is thus related to both intellectual and personality factors, and how does this interaction operate?

2. Cognitive and affective components are both found in developmental stage process (Botwinick, 1967; Lehman, 1953). Does this mean that creativity is related to the developmental stages? Is it actually one aspect of development which recurs in periodic sequence?

3. There appears to be a complex relationship between intelligence, mental health and creativity (Barron, 1963; Maslow, 1954; Rogers, 1959). Is this a straight product relationship (viz: I x MH = C) or is it more complicated?

4. In a replicated research the auxiliary variable, SES (socioeconomic status), keeps appearing as a concomitant of creativity (Solomon, 1968; Tibbits, 1968). Why? How can SES be duplicated for disadvantaged children by school intervention?

5. Is creativity in some sense the opposite of anxiety (Kubie, 1958)? Is its function to resolve anxiety in the individual? What is the relationship between these two variables?

6. Is there any truth to the theory that creativity is enhanced through oedipal closeness to the mother in males, and electral closeness to the father in females (Gowan, 1971; Singer, 1961)? If so, how does this process operate, and would it be possible to simulate it in schools?

7. Related to the previous, why are more adult males creative than adult females? Is this purely a cultural pressure artifact, or does it also relate to the early parental climate?

Is the genesis of creativity in females different and more difficult than that in males?

8. From Wallas (1926) on, researchers have testified to the irruptive nature of creative inspiration, stemming, as Kubie (1958) tells us from the preconscious. How may this function be controlled or enhanced? Does alpha wave biofeedback procedure hold the key? What about psychedelic procedures including drugs?

9. In Maslow's (1954) study of self-actualized people, they were always found to be creative. What does this suggest as the relationship between creativity and self-actualization? Does our culture, in making self-actualization difficult, also inhibit creativity? Could we make changes in it which would advance the possibility of both conditions?

10. What is the relationship between a creative classroom teacher and able children that is most likely to make them creative?

11. What is the relationship between childhood measures of creativity (such as the Torrance tests) (1966), and adult measures (such as creative production)?

12. What is the relationship between the peak experience and creative production (Maslow, 1954)?

13. Why is there often a despondent period in the artist after a creative production (Gowan, 1967)? How can this be prevented?

14. Is creativeness a wavelike or periodic function (Kubie, 1958; Schachtel, 1959)?

ISSUES INVOLVED

1. Non-Positivistic Holism. Stated popularly, this issue becomes: "Creativity cannot be understood or analyzed by positivistic science." There are really two issues here which should be kept separate. One is: "Creativity cannot be understood or analyzed by ANY scientific theory," and with this we most profoundly disagree. The business of science is to incorporate phenomena which have previously defied explanation into a body of knowledge. The second issue is: "Creativity cannot be understood or analyzed in terms of past positivistic theories." With this statement we agree. In the assimilation--accommodation model there must be both assimilation of the new phenomena, and accommodation of past theories. They must be upgraded and expanded to include new territory. The past theories of scientific positivism may not be big enough to explain the new facts. If so, they may need to be expanded into non-positivistic areas.

The history of science has been the continued co-option of research areas from religion or philosophy. Creativity is only the latest of these; (psychedelia (Krippner, 1968; Tart, 1968) is now in the process). We must continue to expect that science will enlarge its boundaries, and that in the future it will be able to explain much more of the universe than it has in the past. To state that there exist phenomena which can never be explained is foolish; it is equally foolish to believe that science will not develop in order to explain them.

2. Creativity and Mental Health. It is remarkable that most researchers in the area of creativity end up by working on mental health, which seems to be some kind of an adjunct variable, although the relationship is by no means simple. On the other hand, many creative people show definite evidence of poor mental health at least at times. How is this discrepancy to be explained? One can posit that creativity is a resultant of early progress toward better mental health, but this is by no means always found. It is also possible, as Barron has indicated, that the relationship is a bit like a man with assets and debts; he doesn't cash in his chips, but he manages to live with both at once. One can also explain this relationship by analogy of a bicycle rider. If he stops, he must dismount, because he cannot balance standing still; but if he is moving forward, even at slow speeds, then he can correct the present imbalance in terms of the forward motion, and thus, keep his seat. It is interesting that Maslow distinguished two kinds of creativity; that in average people dependent on high mental health, and that in geniuses dependent mainly on intellect.

3. Is Creativity a Wastebasket Category? It is obvious from reading the literature of creativity that it means many different things to many different researchers. This being so, one's attention is forcibly brought to the possibility that "creativity" like the common cold may resist analysis because it is a plenum of variegated entities without common properties or characteristics. Guilford, for one, has carefully avoided the

word "creativity" in favor of twenty-four factors found in the slab of divergent production. On the other hand, any new phenomena at first seems to exhibit many unusual and baffling effects, and only later as it becomes conceptualized, does some theory bind all these data into a gestalt. There are certainly broad differences between the exhibitionistic creativity of children, and the more organized and original creativity of adults. There is also a great difference between the problem-solving type of creativity demonstrated by Parnes (1967), and the almost psychedelic aspects noted by Krippner (1968). If creativity is not to become a wastebasket category, we need theory which will help us bind together these many differing aspects.

4. Does Creativity Found in One Stage Develop Into Creativity Found In Another? The first intimations of creativity in the child appear in the Eriksonian Initiative period (4-7) (Erikson, 1963) when the child first explores the fantasy world and begins to assert some control over his environment. The creativity of this period is exhibitionistic, dramatic, often repetitive, and generally fragmentary. This type of creativeness often lasts through the industry period but generally begins to fade (as Torrance (1962) has noted) about age 9-10. Another burst of creativity occurs in young adulthood in the Eriksonian Intimacy period, and is characterized by more unity, coherence, daring, and brilliance. It is truly novel and often displays scope mastery and vigor. Examples of this type of innovation would include Arriaga, Galois, and Chatterton. The major question of

course is: does the earlier type develop into the later type if the environment is favorable? And if so, what are the most favorable environmental conditions? Can only early-type creatives become adult creatives? If not, what are the characteristics of those not in the early creative class? Finally, this line of reasoning suggests the question: Is creativity a periodic function of development?

5. The best present explanation of the manner in which the Wallas (1926) theory proceeds from incubation to inspiration has been given to us by Kubie (1967) in his concept of a preconscious collator which processes information from an immense storehouse of knowledge in disassociated form. Some interesting questions about the nature of this preconscious process arise. Is the storehouse, for example, confined to all the knowledge available to the individual in the past, or does it by involving Jung's (1916) "collective unconscious" reach out to a much vaster storehouse embracing the whole species? Is this preconscious an entity to which the adjective "my" cannot properly be applied, and does it, therefore, take on some of the frightening "uncanny" aspects of the Sullivanian "not-me" (1953)? Is the attempt to control the autonomic functions equivalent to an attempt to control this aspect of the psyche? Since the "not-me" generates intense anxiety when in control of the ego, is creativity an antidote for anxiety in the attempt of the ego to control the "not-me"? These and similar questions involve a basic issue in both creativity and psychedelic research.

CONTRIBUTIONS TO FUTURE KNOWLEDGE

It is an interesting fact that those persons who have contributed most to creativity research have tended also to be those who have espoused humanistic psychology and who have viewed man's future development in very optimistic terms. Few reductionists or behavior modification advocates are found therein. Examples would include besides Maslow and Rogers, Jourard (1968), Otto (1966), Barron (1963), Krippner (1968), Tart (1968), and the writers of this treatise. This coincidence suggests that when we have a unified field theory of creativity, it may play a significant part in integrating concepts in humanistic psychology, and in charting man's progress for future development.

We have already established that creativity is important in the education of children, and in the productivity of science and industry, but important as these benefits are, they pale beside the possibility that creativity research and development may provide us at last with a science of man.

The American Dream of the past which imagines every man as a successful breadwinner and husband, and every woman as a successful wife and mother is no longer enough for most intelligent adults. They want more, and this is what Women's Lib, the hippies, basic encounter groups, Consciousness III, Alpha Wave therapy, Zen Buddhism, psychedelic drugs, and all the other far-out movements are all about. They search for a higher dream of man's development into self-actualization. They explore psychedelia as a possible aspect of this development. Many go

astray and are lost, as is true with all pioneers. But for the first time in America we are seeing groups of intelligent adults, not especially in need of therapy, banding together for mutual development toward an ideal which is beyond the American Dream of the past. Now it is a fact that Maslow, in his famous study of self-actualized people, found none who were not creative. Therefore, we may expect that whatever may be the terminus of this odyssey, creativity is a way-station. This fact in itself suggests that further knowledge, and especially better models of creativity may provide an enormous boon to this ongoing evolutionary thrust.

Toynbee (1964) tells us that every great civilization comes to maturity with a monument and a religion. Our monument is on the moon; our religion could well be a personal humanistic psychology of developmental process which would make all of us creative and self-actualized. These are brave words, but men are the children of Prometheus. We may come from dust, but our destiny is in the stars.

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III. CREATIVE PROCESS

Victor K. Phillips
Department of Educational Psychology
University of Georgia

Introduction

In order to make manageable the awesome task of research, studies in creativity have been approached via three molar divisions: the person, the process, and the product. The influence of the environment, although not listed as a molar aspect, is most often considered and controlled as an independent variant. The following pages will focus specifically upon the creative process and those conceptual orientations most commonly used to describe it.

For the sake of clarity, economy, and generalization, the major conceptual orientations will be grouped as follows: (1) psychodynamic, (2) fulfillment, (3) cognitive and psychometric, and (4) associative. These interpretive approaches do not represent any well defined set of regulations or qualifications but are considered the sources which have contributed most heavily to our present understanding of the creative process.

From the vantage point of each conceptual orientation, the interpretation of the creative process will depend strongly upon several basic premises concerning man's functioning. Is the creative process universal and health-engendering or restricted to the maladjusted few? Are data in the form of

numbers a true reflection of the creative individual's own reality and processes? Should the creative process be considered an all-or-none function or as an incremental, gradual, and unpredictable process? As we shall see, these questions determine to a great extent our current knowledge of the creative process, and the ambits beyond which interpretation of the creative process becomes useless.

Psychodynamic

The psychodynamic interpretation of the creative process was first posited by Freud (1908). Technically, the psychic life of the artist, as with all individuals, is made up of id, ego, and superego. Each of these forces is made functional by biological energy under the regulation of primary (id, unconscious) and secondary (ego, conscious and unconscious) processes. The biological, instinctual impulse drives blindly and impersonally toward the satisfaction of primitive needs. The degree to which the instinctual impulse is successful is determined primarily by ego functions (reality-testing, defenses, reality-regulated strivings, and perceptual-intellectual components) and superego functions (introjects, ego ideal, and conscience).

Based upon the closed energy system embodied in psychoanalytic theory and the secondary processes, the creative process becomes sublimated energy. The individual's creative behavior originates in conflict - conflict which springs directly from unsatisfied, unconscious, biological drives. Acts of

lesser notoriety such as daydreams and fantasies are mirrored examples of the creative process in operation. Each allows the individual conflict resolution by means of privately living out what socially would be condemned. As with night dreams, the daydreams, fantasies, and literary works allow unconscious energy discharge in the form of disguised symbols.

The derivation of each creative act is for Freud ultimately traced back to childhood sexuality. When the child becomes curious about sexual matters (roughly age 3 years), the curiosity may eventuate in several possible outcomes. According to Freud, energy in the form of sexual curiosity may be either energetically repressed, coped with defensively, or sublimated into creative activity. Diverting energy into creative behavior thus becomes the prototypic pattern which is followed in adulthood.

Freud (1920) saw little quantitative difference between the creative process and neurosis, except in the constitutional assets of artists "to sublimize and to shift the suppression determining their conflicts." However, the facility with which the artist is successful both in elaborating primary material and in gaining personal gratification, suggests a qualitative distinction between the creative process and neurosis in terms of ego functions. Although a temporary break in reality (in the form of daydreams, fantasies, etc.) is a necessary condition for the artist to bridge the gap between instinctual impulse and disguised symbol, it is the dynamic unconscious, not

the secondary processes, which Freud emphasizes in the creative process.

Subsequent psychoanalytic interpretations have evolved. These are mainly descriptive of motivational factors rather than analyses of the creative process per se. Where the functions of the psychic apparatus are observed and deciphered directly, two interpretive groups emerge within the psychoanalytic framework. The first group is represented by those who adhere to the orthodox Freudian emphasis upon the unconscious primary process and instinctual conflict. The second group are analysts who emphasize the secondary processes as the nucleus of creative activity.

Those who follow most closely Freud's concept are Stekel (1943), Sachs (1951), Abraham (1949), and Brill (1931). Stekel equated artistic behavior directly with neurosis. Every artist is a neurotic. Sachs, although not as emphatic as Stekel, emphasized maladjustment and the "creative unconscious" motivation permeating artistic activity. For him the impelling urge to create was derived from forbidden wishes and feelings of guilt. By creating, the artist could reduce and relieve his guilt. Abraham (1949) explained the essence of the creative process, as viewed in great contributions made to the world, to be derived from displacement of infantile pleasures in sucking. Displaced sucking behaviors are the bases for traits such as curiosity and observing nature. Since such traits are central to scientific investigation, the contribution the creative

scientist would make is directly related to his infantile sucking impulses displaced to his pleasure of observing and collecting facts. Brill (1931), likewise, would emphasize the oral nature of man as the basis of creative functioning. According to Brill, the primary pleasure of experience is the mother's breast (oral gratification). Later, the breast is replaced by other objects, e.g., thumbsucking, smoking, etc. Since oral gratification is the basic pleasure, Brill interprets the creative process as that function which is expressed through orality. Thus, poetry is a "sensuous or mystic outlet through words, or as it were, through a chewing and sucking of nice words and phrases."

Others such as Jung (1933, 1959) and Schactel (1959) have not fully accepted the psychic model which Freud proposed. Instead they have given unique interpretations of the creative process. Jung depicts creative functioning as being mystical in nature. For him the creative process operates via two modes: the psychological and the visionary. The psychological mode draws on consciousness in filling the content of the created product. In the visionary mode the content of the product is drawn from the "collective unconscious." Since the collective unconscious is the depository of the archetypes - the evolutionary experiences of past generations, the universality in reknown art is given a basis other than the limited experience of the artist's immediate life. Yet in many ways Jung's collective unconscious seems unilateral to Freud's primary processes.

And the reactivation of the archetypes is not sufficiently orthogonal to Freud's concept of id impulse to go without mention.

Schachtel differs with Freud and Jung in that the creative process is neither drive reduction or limited to pre-experiential motives. Schachtel interprets the creative process as man's need to relate to the world around him, to be "open to the world." Yet this is not in itself unlike object relations except that Schachtel's meaning is spiritual in nature.

Hartmann (1958) interprets the creative process as "the prototype of synthetic solution" which to him was the contrasting characteristic between art and fantasying. Here the emphasis is upon ego mobility and autoplastic effects rather than the organization of the unconscious. Rank (1913, 1932) analyzed the creative act as both an attempt to immortalize oneself and an attempt to free oneself of conflict centering around the "will to create." Kris (1952) saw the creative process as "regression in the service of the ego" while Kubie (1958) has stressed the functions of the preconscious rather than purely transformed sexual energy and neurosis.

Others, still within the conflict model, have taken a different position. Klein (1948) and Sharpe (1935) have postulated murder and reanimation of a loved one as the central motivational elements in creating. Guilt motivates the artist to recreate in order to relieve his anxiety. Similarly, Fairbairn (1938) and Lee (1947) have stressed the destructive impulse and consequent creative functioning as restitution for the

destruction. Greenacre (1951) relates the creative process as a body sensitivity and an inadequate Oedipal resolution of the artist. Instead of relinquishing the infantile incestuous object, the artist substitutes for it an idealized image or abstraction. Levy (1940) has interpreted the act of creating as the individual experiencing a series of depressions toward the end of which the artist heals himself by creating beauty in his product.

The difference in interpretation of the creative process between orthodox Freudians and ego psychoanalysts has become more salient in the last several years. A number of current analysts have carried research on the creative process even further. Grinberg (1971) explains the creative act as "the outcome of a process in which current structures undergo a state of transitory disorganization in order to reintegrate later on a different basis." The disintegration and reorganization are aspects of the creative process which are represented in condensed form in the creative act. During the creative act psychotic mechanisms function, but quite differently from those associated with psychotic individuals. In both the normal creative and the psychotic, the initial reaction to object loss is hallucinatory wish fulfillment. But unlike the psychotic, the creative individual can master object loss without sustained blurring of boundaries between self and object, reality and fantasy. But according to Grinberg, the normal creative person can not tolerate disintegrative tendencies for fear of

not being able to "return." In brief, in the creative process a person uses psychotic mechanisms (splitting, omnipotence, idealization, and projective identification) as tools to help him recreate the lost object. The creative process is seen here as going beyond "the reality principle" without breaking with reality.

Likewise, Sterba (1971), Meyer (1971), and de Levita (1971) have emphasized the importance of early identification and object relations as central to the creative process. Sterba identified imagination as the "process that occurs between intrapsychic representative Gestalten." Such Gestalten are formed as a result of perceptions and stimuli received from outside objects. The creative process is the psychological breaking up of old "well-established patterns" of object relationships and establishing new ones, that is, forming new intrapsychic Gestalten. Meyer emphasized object relations of a different sort, that of collaborating with another person as the key to the creative process. It seems that with the desolation of a collaboration the artist is psychologically influenced by death and grief to a higher level of productivity. De Levita ascribes the creative process to a purely elaborative function of the secondary process "inasmuch as it introduces elements from all different parts of the psychic realms - elements which originally were not connected with the stimulus and stimulus-response under consideration but which the inventive ego has found out to be usable in connection with them." Harris (1965) has

extended the importance of object relations in the creative process by demarcating between connectedness-prone synthesizers and disconnectedness-prone analyzers as types of creative functioning.

Other psychodynamic interpretations have departed even more significantly from the Freudian view. Rothenberg (1971) has posited the underlying characteristics of the creative process as being Janusian in nature. That is, the "capacity to conceive and utilize two or more opposite or contradictory ideas, concepts, or images simultaneously." Noy (1967) postulated the creative process and everything integrative and expressive of the self to be part of the primary process. Arieti (1967) went beyond Freud in positing a tertiary process in order to account for creative activity, while Roland (1972) has relegated the primary functions to be subservient to the integrative aspects of the secondary system.

In the main, psychodynamic proponents of the creative process view the creative individual as a closed energy system. Whether or not emphasis is placed upon a specific psychic system or region does not break with this basic assumption. Also, there is the pervasion in all psychodynamic descriptions that conflict (surface or primary) is concomitant to creative activity. And finally, due to the therapeutic process and the objectives involved in therapy, the psychodynamic approach to the creative process substitutes clinical protocols, profiles, and patterns of observed behavior, in place of numerical data. Out

of these clinical observations we begin to see the creative process not as an all-or-none function, but as an incremental, gradual, and almost unpredictable change through which the artist produces.

Fulfillment

There are a few investigators who do not follow either a psychodynamic or cognitive orientation in viewing creative thinking. These researchers have developed independent interpretations which stand more in an eclectic light, and, which offer concepts based upon man's potential for fulfillment. The various descriptive terms reflect each writer's perspective such as self-actualization (Goldstein, 1939; Maslow, 1959; and Rogers, 1959), integration (Hart, 1950), competence (White, 1957), being in the world (May, 1959), and functional autonomy (Allport, 1937).

Goldstein (1939) has posited an interactionist's view of creative functioning. Man's basic nature is to gravitate toward activity and progress. If activity and progress are ultimately achieved, the individual is seen as self-actualizing. However, in order for the tendency to actualization to effect itself, there must be, by definition, a conflict between man and the environment with concomitant shock and anxiety. Thus, creative functioning is synonymous with environmental exposure and the courage to bear one's anxiety while progressing through life. For Maslow (1959) self-actualizing creativeness differs from

special talent creativeness. The former describes the individual as spontaneous, expressive, unfrightened by the unknown, and as able to "synthesize and integrate what appear to be psychological polarities," while the latter refers mainly to recognized products. Creative thinking and creative feeling constitute, for Maslow, the creative process regardless of the environment or popularity and fame. The most accurate representation of the creative process is "the peak-experience," the most ecstatic experience of one's life. Such experience is not limited to either reknowned people or highly intelligent individuals, but can eventuate in any person regardless of status or ability because it depends upon personality rather than achievements. Self-actualizing people have peak-experience as a result of the individual's integration within himself. Such self-acceptance also brings about greater integration between the individual and the external world.

Rogers (1959) defines the creative process as "the emergence in action of a novel relational product, growing out of the uniqueness of the individual on the one hand, and the materials, events, people, or circumstances of his life on the other." The motive which gives impetus to the process is "man's tendency to actualize himself, to become his potentialities." When the individual denies awareness of his own experiences and is closed to them, the creative process reflects destructive and antisocial forms. On the other hand, when the individual is "open to all of his experience," his actions, emotions, and attitudes will

be constructive and creative. For Rogers, the basic conditions that induce the constructive creative process are "openness to experience, an internal locus of evaluation, and the ability to toy with elements and concepts." Certain experiential features incorporated into the creative process are "the Eureka feeling, the anxiety of separation, and the desire to communicate."

Hart (1950) also interprets the creative process as a health-engendering function, although he emphasizes the integrative aspects of the personality rather than a progressive extension of one's self through openness to experience. Since Hart views synthesis as the fundamental characteristic of biological activity, he also considers it to be the prime characteristic of ego function reflected in creative activity. Hart defines the creative process as "an integrative force, because it is fundamentally based on love, and on happy, guilt-free disposal of aggression in socially-acceptable channels." For Hart, creative thinking produces the same traits as physiological health in its struggle toward symmetry, harmony, and completeness, as distinct from distortion and discord.

White (1957) postulates a fundamental drive toward competence as the basis for creative thinking. It is supposedly as potent in determination as the drive to procreate. The key manifestation of the competence drive is exploratory behavior. Although such a view is similar to Adler's (1930) concept of overcoming defects, for White the competence drive is seen as active, playful, eager, and expansive, rather than compensatory.

In this respect, it indicates fulfillment rather than overcoming inadequacies.

Another orientation which defines the creative process in terms of positive experience has been posited by May (1959). May distinguished between pseudo or artificial creative action and truly creative behavior. The latter is "the most basic manifestation of man's fulfilling his own being in the world." The creative act always involves the relationship between the self and the world. To May this relationship is not the same as the subject-object split. There is no separation, because the world is defined as the "pattern of meaningful relations in which the person exists and in the design of which he participates." Therefore, the creative process is represented by the individual's being in the world, existentialistically. The fusion of the objective and subjective is less marked by Allport (1937). Somewhere in the individual's life an activity acquires a "functional autonomy." That is, the creative process is in itself rewarding enough to sustain its application throughout life. Functional autonomy as the creative process requires no special primordial or post-natal source of motivation. The creative act is viewed as a process acquired by experience, and, like a skill will eventually "take possession of the man." As a result, the individual will exercise his talents for the sole reason that the creative process is in itself fulfilling.

In reviewing the fulfillment model of the creative process, several basic premises should be mentioned. In general, the fulfillment orientation emphasizes health as opposed to pathology as a central element. Unfolding and experiencing overshadow healing and restoration. Also, creative thinking is seen as universal, not peculiar to a limited set of productive individuals.

Since the fulfillment approach is a consequence of those authors who have histories of extensive therapeutic practice, the data on which their views are based are derived from private interactions, not numerical evidence. Each contributor has indicated, also, that the creative process may be set in motion, enacted, or energized, in various time spans. For some individuals, it may require years in which the process is an ongoing sequence. For others, a peak-experience may last only a sparce few seconds. Thus the creative process, according to the fulfillment model, may be both incremental and lengthy, or an all-or-none event. Nevertheless, the central concept is that creative thinking evolves out of human growth and vice versa.

Cognitive and Psychometric

The forerunners of contemporary cognitive and psychometric interpretations of the creative process are seen in philosophical, semi-experimental and measurement essays written more than forty years ago. At the turn of the century, Royce (1898) suggested that invention came about as the result of breaking old habits,

habits specifically related to both intellectual and social behaviors. By varying habits, new combinations of intellective life are produced. For Royce, any change of habit which brings about new combinations rests solely upon the "plasticity to experience" which each man possesses. Ribot (1906) too viewed creative imagination in terms of plasticity, but added four more types of processes such as diffluent, mystic, scientific, and practical. Such types of imaginative thinking are treated independently of each other and lack the reference to the creative process as an integrated system. Later, Boraas (1922) indicated that the ability to imagine not only encompasses a fund of available memories, but that imaginative thinking also "depends on a want to be satisfied or an aim to be attained." Since the "aim" is the production of something new, "and not a reproduction of past experience, the process is essentially one of thought rather than memory."

Some of the germinal seeds which generated consequent cognitive and psychometric research on the creative process are found in such expository writings as those of Poincare (1913), Wallas (1926), Dimnet (1928), Spearman (1931), and Hirsch (1931) Poincare outlined the progression of changes involved with mathematical creation. First, "one works at a hard question." This conscious effort ends as "nothing good is accomplished at the first task." Secondly, "one takes a rest." Next, in a brief span to time and "all of a sudden the decisive idea presents itself to the mind." Poincare suggests that the key

element or solution came about as the result of unconscious work during the rest period. Though conscious effort is prerequisite, it is the refreshing and reinvigorating rest spliced into the hours of conscious abtempt which brings about the spontaneous and excited solution.

Later, Wallas formally postulated a four stage model of the creative process. Until Wallas' formulation, other attempts employed in unraveling the functioning creative mind centered around logic, standard and novel problem-solving measures, and imagery studies (Markey, 1935). Although a few texts such as those by Knowlson (1920) and Robinson (1921) illustrated transformational aspects in the creative process, most studies treating creative mentation did so in terms of a byline to support an alternate theme such as freedom (Bergson, 1911; Dewey et al., 1971; and Alexander, 1920), or religion (Brightman, 1925), or ethics (Peirce, 1923; and Driesch, 1924).

Wallas (1926) went beyond mental content and habituating behaviors. He proposed sequential stages in the psychological activity of creating. Such a process, although not necessarily irreversible, began with preparation, the initial stage in which the organism defines and clarifies the problem. Preparation is most heavily characterized by activity of collecting data, expanding fundamental knowledge, and exposing oneself to all available and pertinent information. The second stage hypothesized by Wallas is incubation, the period of time which usually follows ingestion of information and which is generally considered

the stage in which unconscious activity occurs. During incubation the initial focus on the problem is ignored, or shifted, or left unattended. The subject involves himself with other activities not related to the crucial problem. The third stage is illumination which signifies a tentative and rapid formation of a potential solution. It is in this stage that overt indications appear which suggest that central elements have jelled in the form of a tenable solution. The final stage suggested by Wallas is verification. Verification reflects a basic aspect of creative functioning which demands that the potential solution be corroborated or substantiated as workable.

Dimnet (1928), although not as systematic as Wallas, comes to similar conclusions in dealing with the creative process when related to intuition. He describes the initial activity as "some difficulty which we have been fighting with," followed by transformation, a "revelation of the something indefinable," then, "suddenly an illumination flashes upon us," and finally "we become conscious of the repose accompanying certitude."

In Spearman's (1931) treatment of the creative process, a theory of insight is issued which is based upon educing correlates, i.e., by analogy and proportion. Spearman is gravidly involved with formal principles of logic in problem solving, yet his contribution to the understanding of the creative process is seen in the manner he would remind us that even in the most creative act there are elements of reason. Likewise, Hirsch (1931) treats psychological processes from the formal

logistical viewpoint. Here the creative process is described as the last of three intellectual dimensions based upon instinct, of which the first two are cognitive intelligence and objective intelligence, respectively. Genius is equated with creative intelligence and further subdivided into artistic and scientific prototypes. It is in relating artistic genius that Hirsch contributes to the knowledge of the creative process. Here we see primarily for the first time the notion that intelligence alone is insufficient in knowing the constituents of the creative process. Nor are instinctual processes adequate as an interpretation. Hirsch describes the creative process as "intuition, the inspirational idea, the erupting gleam, first flashes, followed by critical intellective work of improving, revising, adding, subtracting ... the radiant glow that translates an incongruence of hypotheses and a multiplicity of facts into a harmonious unified system ..."

Other theoretical formulations which have preceded contemporary cognitive and psychometric research have given alternate views of the creative process. Bartlett (1928) differentiated true imagination from flights of fancy in that the latter is always fragmented whereas the former "is to be found in the whole imaginative structure considered in its completeness." Imagination is of three types. Assimilative imagination reflects the feelings of the individual and a non-critical cognitive attitude toward the situation in a global sense. Here changes are made which are not the consequence of critical evaluation,

but more akin to changes that are fundamental drives beyond the control of the individual. The second type of imagination is creative interpretation in which critical evaluation is ongoing in an intrinsic sense, yet not of a rational nature. The last imaginative type differs from the first two in that, for no apparent reason, submissiveness is replaced by an attitude of dominance or mastery.

Others such as Dashiell (1931) and Duncker (1926) have not emphasized the receptivity-mastery continuum of the creative process, but have focused upon specific characteristics of creative thought. Dashiell emphasizes the suddenness or unexpected manner in which ideas occur, the relative state of relaxation in which they appear, and the obscure origin of the key ideas. Duncker believes insight to be related to stimulating content of the problem situation. That is, tension or conflict predisposes the individual to penetrate into the circumstances. When the "functional values" of the problem situation are grasped and insight occurs, abstraction takes place which is followed by a realization period. The realization period constitutes the execution of the functional values so as to render a solution to the demands of the situation. Fernberger (1936) also views creative imagination in terms of rearrangement. But unlike Duncker, the rearrangement is not in the functional values of the situation, but of old concrete images processed by the individual.

At the turn of the century and well into the twenties, imagination appeared to be of great import as a potential research variable. Most studies investigating the creative mind did so in terms of imagery. It appeared only reasonable that if successful inventors, creative artists, and eminent men possessed richer imaginations that dissecting the content (images) of such imagination would yield what had heretofore perplexed the investigator. Apart from philosophical essays and literary evaluations, studies were conducted on perceptual phenomena so as to relate imagination, vis-a-vis imagery, to intellective life. Studies by Burnham (1892), Stetson (1896), Lay (1898), Chalmers (1900), Colvin and Meyers (1909), Perky (1910), Ogden (1913), and Bowers (1929) had indicated that imagery types are distinct, that image-thinking enhances aesthetic appreciation, that creative imagination implies mental imagery, that stress on imagery interferes with literary interpretation and comprehension, that with increasing age there is a fluctuation of auditory and visual imagery types, that one can obtain rater reliability of images, that there is a relationship between imagery and number form, that affective patterns are reported in conjunction with memory images, that memory images are spontaneous and distinct in imagination, and that more associations appear with imagination images. Yet none of the studies mentioned above attempted to integrate the findings into a formulation of the creative process.

Other approaches generally emphasized identification and assessment of variables related to creative problem-solving abilities (Dearborn, 1898; Winch, 1911; Whipple, 1915; Chassell, 1916; Slosson and Downey, 1922; Teague, 1922; and Hargreaves, 1927). In such studies, data were gathered from adults or children via standard measures or variations of ink blot tests, and the results often reflected traits or abilities, but there seemed to be no consideration of the creative process per se. Other studies too reflected the global concern with creativity proper, but not infrequently were the results intended as test construction, test reliability, or as physiological relationships such as kinaesthetic forms of imaginative activity (Jacobson, 1929) and types of imagery (Henning, 1923).

During the third and fourth decades of this century the literature contained a flurry of studies treating thought and reasoning. Of investigations utilizing human subjects were those focusing on trial and error, insight, concept formation, motor accompaniment of thought, and so on (Gibson and McGarvey, 1937);and Durkin, 1937). As Hutchinson (1931) had indicated earlier, there simply was no literature on creative thinking unless one were to recount older efforts treating "philosophy, intuition, mysticism, literary criticism, art, invention, and genius." Until this time frame, there appeared no central or consistent thread which could be identified as an interest in investigating the creative process. The diffuseness which characterized the scant and disparate articles on creativity,

and much more the specificity of the creative process, gave way to the perseverance of several authors who had generated greater interest in the topic.

Hutchinson (1939, 1940, 1941, and 1942) had taken Wallas' basic four stage model and explored the emotional concomitants at each phase. Where Wallas had posited preparation, incubation, illumination, and verification in the creative process, Hutchinson found inseparable affective elements. Incubation predisposed the individual to restlessness, feelings of inferiority, renunciation, and recession in defense of emotional balance. Illumination not only meant solution but also hallucinatory vividness of ideas, emotional release, and feelings of adequacy which negated symptoms of neurotic maladjustment springing from the preceding stage of incubation. Finally, the period of verification not only allows a test for the communicable and social value of the product, but more important to the individual, it allows the experience to be cohesive, to be a health coordination within the person.

Gordon (1935, 1937), also interested in the affective components of the creative process, has interpreted imagination with emphasis upon psychic activity. It is in becoming "conscious of our desiderata" that an impetus is given the creative process. The process includes the transformation of psychological activity into concrete objects, the reduction of vague unrest, and the clarification of the goal. Although Gordon does not specify sequences in creational activity, she does,

nonetheless, indicate the importance of motivation which leads to the process of imagining.

A more experimental corroboration of Wallas' model was indicated in the studies by Patrick (1935, 1937, 1938, and 1941). She compared poets to non-poets, artists to non-artists, various occupational groups and scientists in terms of methodologically defined stages in the creative process. The results of the experiments support not only the existence of Wallas' stages, but also that an overwhelming number of subjects attested to the sequence. In addition, she found that the majority of subjects indicated that "whole" as opposed to "part" concepts to be more important in the creative process. Other studies which have offered agreement with Patrick's findings are Platt and Baker (1931) and Rossman (1931).

To be sure, Wallas' model was not the only interpretation of the creative process during the thirties. Grippen (1933) conducted a study in which she compared the creative artistic imaginations of children. Her results led her to offer seven categories which exhaust the possible ways in which children's artistic conceptions evolve. Although she was not interested in the sequence of such categories, several (organization, revision, improvisation, and fusion of elements) are not far removed from Wallas' conceptions.

Other researchers closely aligned with the cognitive and psychometric approach to the creative process have used apparati in order to investigate creative functioning. In a series of

experiments, McCloy and Meier uncovered several important aspects concerning creative activity (McCloy, 1939a, 1939b; McCloy and Meier, 1939; and Meier, 1939). Their results showed that levels of active and passive creative imagination as related to the subjects under study were not dependent upon training, chronological age, (except very young Ss), sex, race, or IQ.

Moving through the forties, we recognize the establishment of several trends. First, there is a distinct interest in the creative process as a legitimate area of research. Secondly, acceptance of those models of the creative process which reflect a sequence of generally consistent stages (not necessarily in any distinct progression) is evident. The study of the creative process is no longer equated with madness, religiosity, or hereditary genius. The forties engendered a genuine concern with cognitive and psychometric aspects of creative thought. Though the Second World War decreased the number of publications, the collective concern remained and grew.

Several authors have attested to the creative process as indeed representing various stages of cognitive functioning. Husband (1940) explained invention as the most complex forms of thinking, reasoning, and imagining. In the creative process, the stages develop as a result of the individual recognizing a need. When the need is realized the consequent behavior is characterized by casting about for a possible solution, selecting one, evaluating, criticizing, and revising it. Willman (1944) interpreted selection not simply as a possible stage in

the creative process, but maintained that for composing musicians the creative process was almost totally a selective process. That is, the selecting involves choices among large numbers of possibilities, and the relationships between the choices and the specific situation.

How much the situation determines the direction of the choice has also been investigated. That situational elements (perceptual field) and relationships between these elements affect and comingle with the creative process has been presented by Wertheimer (1945) and Feibleman (1945). Wertheimer has broken the creative process down into two segments, the beginning of thought and the solving aspects. The first relates to the stresses and strains that are produced by the structural features of the immediate situation. The second segment is determined by factors in the situation that reduce the tension by setting up a harmony between the requirements of the situation. Feibleman views the relationships within the situation in terms of restructuring also, but would interpret the stresses and strains as not necessarily derived from the perceptual field, but from the need of the individual to express his new experiences in the situation.

Portnoy (1949) agrees that sensory perceptions often begin or initiate the creative process, but he separates the "beholder" from the "maker" in that the perceptions of the former do not lead to sensitivity and the concretizing of his emotions in some external form. In examining poetical works, Arnheim et al.

(1948) corroborate emotional concretizing as an element in the creative process. Spender (1946) intimates that such a transformation from creatively processing thoughts and affects into the outward, concrete form may be motivated by the need to communicate to others an understanding of one's self. Patrick (1949) derives the motivation of the creative process not so much as a need to communicate but that the problem at hand induces an unfulfilled want which disturbs the organism's equilibrium.

At any rate, the concepts of restructuring, communicating, and fulfilling a want indicate a basic tension that manifests itself after a specific problem has been accepted as such by the individual. The question as to whether or not the creative process may transpire without such an impetus has not been answered.

And, finally, during this decade a number of authors directed their energies toward assessing the relationships between specific aspects of mental functioning and creativity. Several investigated cognitive operations, via psychometrics, that appeared to be relevant to creative behavior. As a result of this psychometric wave, various tests were devised and constructed so as to procure a keener view of the creative thinking processes (Blair, 1940; Englehart and Lewis, 1941; Fisichelli and Welch, 1947; Thorndike, 1949; Welch, 1946; and Bennett and Uesman, 1949).

By the end of 1950, the contemporary cognitive and psychometric study of the creative process was firmly established.

Guilford (1950) had indicated nine factors of creative thinking which he believes to overlap with and extend beyond the domain of traditional intellectual functioning. He hypothesized the creative process to reflect a sensitivity to problems, ideational fluency, flexibility of set, ideational novelty, synthesizing ability, analyzing ability, redefining ability, span of ideational structure, and evaluative ability. After several studies, mainly factor-analytic investigations (Wilson, Guilford, and Christensen, 1953; Wilson, Guilford, Christensen, and Lewis, 1954; Guilford, Kettner, and Christensen, 1954, 1956; Guilford, 1956, 1957, 1958, 1959; Guilford, Christensen, Frick, and Merrifield, 1957; Christensen, Guilford, and Wilson, 1957), Guilford had found the composition of productive thinking to be convergent and divergent in nature. Divergent thinking factors which reflect cognitive aspects of the creative process are adaptive flexibility, spontaneous flexibility, originality, and elaboration. These principal functions of the creative process characterize the individual as allowing himself to go off in different directions during the creative act. Characteristics associated with divergent thinking ideational fluency measures include impulsivity, self-confidence, ascendance, appreciation of originality, and less inclination toward neuroticism. Those characteristics related to the originality measure are an interest in aesthetic expression, meditative or reflective thinking, tolerance for ambiguity, and less need for orderliness.

Based upon these factor-analytic studies, Guilford has presented several important considerations relevant to the creative process. First, the creative process is not a simple affair, but multifarious and very complex. Secondly, creative thinking is universal, and not an exclusive function restricted solely to successful artists, scientists, and the like. Thirdly, the creative process (divergent thinking) is orthogonal to convergent or traditional intellective thinking. Certainly the two overlap, but the creative process reflects an abundance of non-stereotyped, non-formalized thinking operations. And lastly, however dynamic the creative process is described as being, it appears to be somewhat normally distributed in the general population.

Also based upon his extensive factor-analytic projects, Guilford (1956) has proposed a theory of intellectual functioning symbolized in the graphic cube he refers to as the "structure of intellect." The cube has three sides which represent operations, products, and contents. Although the model encompasses virtually all intellective life, the portion which interests us is the cross section which represents divergent thinking. According to Guilford, divergent thinking operations (creative process) may contain contents in figural, symbolic, semantic, or behavioral form. These contents may be processed in units, classes, relations, systems, changes, or implications. The advantage of this theory of the creative process lies in the inclusiveness of its application. That is, the model is not

limited to any specific types of energy, environment, or ways of communicating. It allows for a wider range of investigation into the more specific details of creative functioning.

More specifically, Guilford (1967) has presented a problem-solving system derived from the structure of intellect model. Although the communication system processes general types of problems, it also represents the sequences involved in creative thinking. The steps or stages involved with divergent production consist of (1) input, (2) filtering, (3) cognition, (4) evaluation, memory, and/or production, and (5) exit. Comparing Wallas' four-stage model to Guilford's communication system, we see at once a feasible fit. Preparation, incubation, illumination, and verification can readily be fitted into Guilford's system. But Guilford's model allows for additional coverage of the specific stages in Wallas' sequence. That is, by providing for a memory storage, the various lapses of time reported as incubation are now understandable. It is plausible that new input interacting with memory storage material not only takes various allotments of time, but such input may be transformed, producing unique ideas.

Brewster Ghiselin (1952) has presented more of the feeling aspects of the creative process as in counterdistinction to Guilford's "thinking" orientation. For Ghiselin the creative is "the process of change, of development, of evolution in the organization of subjective life." He describes the process as beinning with feelings of unrest, dissatisfaction, a yearning

for the new, an almost hazy feeling concerning something novel. The fruits of the creative process are almost never the sole products of conscious effort, but are primarily derived from unconscious operations since change is easier in the unconscious. Change is easier because unlike consciousness, the unconscious is not inhibited by will and attention. Yet the changes in the unconscious are made spontaneous by "intensive conscious effort."

Evidence that undue attention to structure and regularity may be disruptive of the creative process has been obtained. Extrapolating from data obtained from poets, writers, etc., Barron (1963) has posited several antinomian concepts involved in the creative process. Among the more consistent opposites have been independence-dependence of judgment and preference for simplicity-complexity. The premise underlying these dialectic concepts is that "at the very heart of the creative process is the ability to shatter the rule of law and regularity in the mind." This ability is activated by two opposing tendencies: "the tendency toward integration and the tendency toward disruption of structure and diffusion of attention and energy." Variables reported to be highly related to successful creative processing are preference for complexity, independence of judgment, self-assertion, dominance, and rejection of suppression as a mechanism for the control of impulse (Barron, 1955). Cognitive preference for complexity appears to be a strong discriminative concept, not only for creative writers but for creative research scientists (Gough, 1961) and creative

architects (MacKinnon, 1961), as well. It would appear that the relation between preference for complexity and the creative process is a strong one. Initially, and after sensing or becoming aware of the problem, the individual must prepare himself in terms of exposure. Since complexity represents diverse and numerous elements of information as opposed to simplistically limited input, the individual preferring the exposure to more material would tend to succeed in the preparation stage, whereas the person choosing the simple sould be self-limiting in terms of fewer bits of available information. Also, the individual preferring complexity would possibly reflect a more sophisticated level of processing since an openness to more data indicates a facility for examining it in one manner or another. Evidence that highly creative, as opposed to less creative persons, are more sensitive to cues and that they possess the ability to utilize these cues has come from Mendelsohn and Griswold (1964). They state that "highly creative individuals may retain more of their stimulus experience in such form that it can appear in their associative and problem-solving processes ... whether or not it appeared relevant to a given problem at the time of reception, is more available to such individuals during subsequent problem-solving."

Independence of judgment is also active within the creative process. The most distinct feature of independent judgment is the individual's total reliance upon his own perceptual and cognitive evidence, not the evidence conveyed by others. In

the creative process not only must the individual focus upon relevant information, often to the exclusion of other input, but he must eventually judge which parts among the relevant data serve the problem best. Likewise, in verifying a tenable solution, the veridical test of the solution will be initiated independently by the individual as he compares and concludes his final decision.

Taylor (1969) views independence of judgment and preference for complexity as aspects of the creative process which are subsumed in his transactional interpretation. For Taylor the creative process involves "a variety of transactional processes and perceptions directed at altering or reorganizing a significant portion of the environment uniquely, relevantly, and in accordance with one's personal patterns of needs, hypotheses, judgments, or, in a word, perception." The individual may operate on any of three levels within his environment. He may react to the environment, he may interact with it, or he may transact within it. Respectively, the three levels are equated with "behvior, becoming, and being." Each level reflects the relative control which the individual possesses in his immediate life situation and thus in the creative act. Specifically, the operation of perceptual transaction occurs as a result of a "discrepancy between the inner world of personal perception and perception of the outer world." Such a disparity produces "organismic tension." The tension may be reduced in one of two manners. The individual may change his inner world to agree

with the outer, veridical environment, thus producing conformity, or he may "alter or re-organize the environment" so as to make it congruent with his personal inner world, thus producing creative change. Such a change would seemingly require independence of both perception and judgment.

Taylor has modified Wallas' four stage model so as to incorporate both perceptual and assimilative concepts within his transactional theory. The creative process becomes a transaction involving perceptual input, assimilation, transformation, and a product embodying the transaction. Perceptual input of the environment represents an "exposure" stage which others have referred to as "preparation, introjection, sensitivity, awareness, complexity, or opernness"phases. Taylor suggests that sensory saturation may produce the initial stage of the creative process. Perhaps preference for complexity, which was mentioned previously in Barron's experiments, does indeed represent quick saturation of information and has the starter or stimulus qualities which induce perceptual processing of environmental elements.

After perceptual input has relatively ceased, Taylor suggests that an "implosion" takes place. The perceived material bursts convergently inward at a very rapid rate toward a single reformulation. Again, alternative labels for implosion have been offered such as "incubation, internalization, information processing, personalization, and intra-action of perception." When the conversion of perceptual materials or input has been

completed so as to represent a reformulated whole, "closure" takes place. That is, insight occurs. Related synonyms are "illumination, discovery, problem-solving," etc. Taylor states that "this dramatic phase in which perceptions of the external world are reformulated is at the very heart of perceptual transaction and is creative if the reorganization of the environment is congruent with prior personal perceptions."

The terminal stage in the creative process begins with an "explosion" or an expression by the individual which reflects a force coming to the surface in the form of development, formulation, and fluency. The final stage ends in "production." This phase is virtually equivalent to Wallas' verification stage and other concepts such as "projection, externalization, actualization, execution," etc., which have been used to describe the extrinsic evidence wrought by the creative process.

Globally, Taylor partitions the creative process into two essential conditions: plastic perception and plastic communication. The former being more directly related to the exposure stage, the latter more relevant to execution of the results. The term plastic perception refers to the ability to see "the same thing in many ways." Likewise, plastic communication denotes "flexible transformation" oftentimes in non-verbal and abstract ways. Both conditions describe a type of freedom known as cognitive flexibility in which control is a key factor. Psychometric evidence supporting the existence of creative cognitive control has been demonstrated by Stein and Heer (1954),

Hersch (1962), Hyden (1959), Pine and Holt (1960), and Garwood (1964).

Other perspectives of creative cognitive control have been described. MacKinnon (1971) offers an interpretation based upon the individual's active-passive orientation. He points out the difference with which creative people "relinquish conscious control and face without fear or anxiety impulses and imagery arising from more primitive, unconscious layers of the personality." MacKinnon views the process of volitional shifting of such controls as "transliminal experiences" since it is not only active in the creative process but is a crucial alternation contributing to creative success within the process. Transliminal experience is not a one-way affair, for it encompasses both the re-emergence of unconscious material and the making unconscious of conscious thoughts. Creative cognitive control in terms of transliminal experiences indicates a strong relationship between incubation timing and plastic perception since new forms have a greater probability of occurring and there is less interference of self-imposed rigidity. That is, the fear of dealing with strange and/or familiar concepts is minimized while slow or rapid shifting is operative. A similar description of the control involved in utilizing both reality and phantasy associations in the creative process has been given by Turner (1968). When the individual touches upon rather threatening reality or concrete associations during preparation or incubation, he abstracts from these concepts and causes the balance to break up,

to shatter. The abstracted association is now out of context and thus takes the form of a phantasy entity. The creative process by which the entire sequence occurs is described as "syntribination," meaning to shatter reality images thereby producing novel concepts.

DeBono (1969) has described cognitive aspects of control as either vertical or lateral thinking. The former represents traditional problem solving which emphasizes one method, one approach, one set of parameters, tight control, certainty of results, avoidance of instrusion, and established patterns of reality-bound information. The process of lateral thinking requires creative modulation. It is similar to syntribination in that it seeks to break down established patterns into small bits. Control may be necessary to a degree, but lateral processing reflects no sequential nature as a model of creative thinking because jumping and filling in gaps are major objectives. The characteristic of lateral thinking which is most indicative of cognitive flexibility is the attempt to disrupt patterns so "that the information released may reform into new and better patterns." Lateral thinking is creative processing and is similar in many respects to tolerance of ambiguity as posited by Frenkel-Brunswik (1948). Tolerance or intolerance of ambiguity influences cognitive and perceptual functioning. Intolerance of ambiguity is related to a reluctance to think in terms of probabilities and a preference for certainty and clear-cut solutions (Frenkel-Brunswik, 1949). This is precisely

the salient characteristic that defines vertical thinking. Conversely, tolerance of ambiguity, like lateral thinking, indicates an openness to possible alternatives that evolve from both paradoxical opposites and dissimilar elements of information as perceived simultaneously. Evidence that tolerance of ambiguity, that is, unprejudiced openness to uncertainty and acceptance of negatives in addition to positives, is a vital aspect in the creative process has been shown by Pelz (1960), Kahn et al. (1964), and Andrews (1962). These experiments indicate that the creative individual functions at a more beneficial level as a result of his tolerance of uncertainty and ambiguity. Such creative functioning requires a varied amount of risk and going beyond what is already available. In addition, it has been shown that highly creative persons not only choose particular creative problem-solving strategies but choose those strategies which involve the most risk (Phillips and Torrance, 1971). DeBono has suggested that vertical thinking is digging the hole deeper, whereas lateral thinking is going beyond to dig the hole somewhere else.

Other authors of the cognitive and psychometric orientation have attempted to work backwards in an end-to-beginning manner in treating the creative process. Two examples which have emerged are Osborn (1957) and Gordon (1961). Each has moved from observed group or individual active behavior to later defining the processes involved with creation. In applying various procedures for increasing inventive productivity and

functioning, Osborn has developed a scheme for the creative process which follows seven idea-developing phases: orientation, preparation, analysis, hypothesis, incubation, synthesis, and verification. Although the overall scheme is similar to Wallas' concept of the creative process, Osborn replaces illumination with synthesis, possibly because "putting the pieces together" is closer to methodological affirmation in a psychometric sense. Also, Osborn has basically expanded the preparatory stage to incorporate "pointing up the problem" in addition to gathering data.

Gordon (1961) has defined the creative process as the "mental activity in problem-stating, problem-solving situations where artistic or technical inventions are the result." The behavioral operation whereby the process manifests itself is termed "synectics." Synectics denotes joining together different and apparently irrelevant elements. The synectics process (assumed directly equivalent to the creative process) involves making the strange familiar and making the familiar strange. Techniques for making the strange familiar are essentially by analogies whereby the problem may be more concretely viewed. However, techniques for making the familiar strange involve personal, direct, symbolic, and fantasy analogies. These mechanisms are "to be regarded as specific and reproducible mental processes, tools to initiate the motion of the creative process to sustain and renew that motion." The process of synectics reflects deliberate effort in processing creatively on

both cognitive and affective levels. Cognitively the creative process is inervated and carried out in terms of group members using direct analogy and symbolic analogy. Group interaction based upon personal analogy and fantasy analogy give affective interpretations which also tend to make the familiar strange and thus creative. Synectics is one approach to the creative process in which, according to Gordon, an attempt is made to "research the creative process in vivo, while it is going on." In doing so we gain insights about the creative process in terms of its "underlying, non-rational, free-associative concepts which flow under the articulated surface phenomena." Generally, a synectics session discloses the following stages in the creative process: preparation, narrowing, restructuring, insight, and verification. Either due to time limits or an atmosphere of high excitement, the stage of incubation is difficult to detect. Incubation may be restricted as a consequence of Gordon's emphasis upon oscillation between involvement and detachment as the initial phase in the creative process. If each member alternates in this manner so as to control his distance from the problem, it seems reasonable that incubation could be eluding detection, even by members themselves. Under such conditions, incubation would not follow a definite pattern, but would be controlled by some other situational agent. Indeed, evidence has been cited that creative problem-solving may be enhanced when incubation is directly manipulated (Fulgosi and Guilford, 1970).

In conclusion, cognitive and psychometric investigators agree that the creative process is a universal phenomenon. Everyone can think creatively to some extent. Whether the quantified evidence describing the creative process takes the form of biographical frequencies, test scores, or projective technique tabulations, the accumulated data indicate great complexity. Because dynamic and developmental variables as well as cognitive factors are operative within the total creative act, no psychologist under the present rubric would dismiss data based upon interviews or observation as irrelevant. That is, data in the form of numbers reflect only a part of the creative individual's reality and processes. Finally, the question as to whether or not the creative process is an all-or-none function, there is no conclusive answer. Certainly, phases or segments within the more molar process appear instantaneous, but do so differently and under various conditions. Insight or illumination, for example, seems contained or fixed, yet frequently we see finalized ideas repolished after deliberation and/or fatigue. The cognitive and psychometric interpretation views the complexity of the creative process as reflecting gradual, varied, and at times, unpredictable solutions. What does emerge with relative predictability is an agreement upon the basic model of creative functioning. Though various authors have altered, elaborated, or appended additional stages, most cognitive and psychometric investigators accept the basic four stage model presented by Wallas.

Associative

Several interpretations of the creative process have developed from stimulus-response theory. In an attempt to explain the uniqueness, suddenness, and unexpected nature of creative solutions, several authors have given variations of Hull's (1935) habit-hierarchy model. Others have followed Skinner's (1966) operant conditioning paradigm.

Mednick (1962) has developed a theory of the creative process based upon the Hullian concept of an associative hierarchy. Divergent thinking is the result of remote associations made between stimuli and unlikely responses. The environment plays a large role in creative thinking because associations require previous exposure and what has been learned determines whether or not the process is successful in linking novel responses to stimuli.

Beneath stimulus-response approaches to creative thinking is the assumption that responses are arranged in a pyramidal hierarchy. Those responses closest to behavioral expression and highest in probability of occurrence are considered commonplace, non-original, or uncreative. Those responses with least likelihood of appearance are equated with true creativity or novel thinking. Maier et al. (1968) have distinguished between the two as reproductive and productive (creative) thinking. For Maier, productive thinking consists of associations of multiple elements combined in new ways. The relationship between

these combinations and their probability of occurrence is not clear. Nor is the question of creative-task relevancy explained.

Although Maltzman (1960) has proposed that the creative process consists of novel and appropriate associative behaviors, his central theme has been the influence of operant conditioning upon the creative process. More accurately, he has asked whether or not the creative process may be facilitated by operant training. One important feature uncovered in a series of his experiments (Maltzman et al., 1964) showed that operant conditioning of the creative process failed when the originality or creativity criterion consisted of a single correct element. That is, under conditions ignoring task relevancy and single correct answers, operant training of associative elements may become possible. When the creativity-relevant criterion is controlled, positive increments in original verbal thinking under operant training conditions fail to materialize (Caron et al., 1963). Such data suggest that operant training in remoteness of associations is not equivalent to operant training of creative associations, and that creative functioning is not solely influenced by environmental variables. This point is well emphasized by Riegel et al. (1966), who analyzed the associative behavior of high and low creatives and found that "the number of elements available to the subject is only one and possibly not even the most important prerequisite of creative processes." They emphasize classes and class relations in the form of information incoded and recoded as associated

"chunks" of various orders. Instead of single units or elements functioning in the creative hierarchy, the associative theory of the creative process substitutes chunks of information. How the chunks are recoded is not explained.

Others who have advanced concepts of the creative process as essentially associative in nature have been Bronowski (1958) and Haefele (1962). Bronowski views the creative act as an individual's attempt to make unity from diversity. The creative person discovers a similarity between phenomena that were previously considered unrelated. By the association of concepts new combinations are formed. Haefele is more direct in relating the process of creation to associative thinking. He relates the activity as "the ability to formulate new combinations from two or more concepts already in the mind."

In summary, information treating the creative process which constitutes the associative viewpoint implies several general premises. Since S-R researchers focus upon behavior and what the individual has, in actuality, learned, theorizing about the nature of the creative process is almost nonexistent. As a result, a model of the creative process in terms of sequential stages has not been postulated. What we have is mainly response probability and an emphasis upon laboratory evidence in terms of pre-specified answers and environmental control. The question as to whether or not the dependent variables reflecting creative functioning are soundly based in logic and empirical history is not equally treated. Also, there is no

place in S-R interpretations for an assumption concerning the "inner man." The creative process is construed as either overt behavior or processes which are physiologically mediated. It is not clear, either, if a distinction is made between general problem solving and divergent thinking beyond "remoteness of associations."

Finally, the notion that creative associations occur primarily in a chance trial-and-error fashion is inordinately cumbersome and raises more questions than it resolves (Shapiro, 1968).

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IV. CHARACTERISTICS OF THE CREATIVE PRODUCT

D. Jack Davis
North Texas State University

Restatement of Problem

A product is, by Webster's definition, "anything produced as by generation, growth, labor or thought, or by the operation of involuntary causes..." In thinking specifically about the creative product, one might logically delimit the definition to include that which is brought forth or yielded by the process of creative thinking. In actuality, the creative product is the concrete or tangible evidence of the internal process of creative thinking. While it is at best only an indication of the creative process going on inside the individual, it is generally the best evidence we have of that internal action or response.

When one thinks of the creative product and its characteristics, it is usually on a generalized level and most often revolves around the notion of originality, uniqueness, uncommonness or elaborative quality. Furthermore, these characteristics have generally been dealt with on a quantitative basis only. That is, we have determined the originality of a product by its uniqueness of occurrence within a given number of responses. When we have talked about the elaborative quality of a product, we have delineated the number of elaborative details. While these quantitative characteristics have been useful as generalized

indicators of the creative thinking process, they have not attended to an equally important dimension of the product - its qualitative aspects.

Thus, the problem of this paper is to explore the qualities or characteristics of these overt expressions (products) as they relate to educational practice through a review of relevant research, an identification of research needed to advance the area, a discussion of some theoretical and methodological issues involved, and a discussion of the expected contributions which the needed research could make to knowledge and practice.

Review of Relevant Literature

A look into the existing literature on creativity does not reveal a great resource of information relating directly to the creative product and its characteristics or qualities. While creative products have figured importantly in the extensive writing and research in this area by virtue of the fact that they have been the data which have been examined and analyzed for the investigations into the creative personality, the creative thinking process, and creative thinking abilities, the emphasis has been on the behavioral dimension rather than the phenomenological dimension.

To look at the creative product per se for its characteristics or critical properties has not been the object of major research efforts. Thus, relevant research related to the topic of this paper comes mainly through implication from the

investigation of other concerns rather than from research related directly to the issue at hand.

Because the development of measurement devices in the area of creativity has been fundamental and basic to all other efforts and because the measurement of creativity or creative thinking has been totally dependent upon some tangible, observable output (a product), this area seems to offer the most implications for our concern with the qualities or characteristics of the creative product.

While an exhaustive review of research related to measurement seems inappropriate within the context of this paper, it does seem pertinent to note some of the basic work in the area which has provided a continuing influence in the field. Looking at the early work of Guilford and his associates (1951, 1952, 1953), 8 criteria or factors were identified to measure creativity in the exact and applied sciences:

1. Sensitivity to problems
2. Spontaneous flexibility
3. Adaptive flexibility
4. Originality
5. Redefinition
6. Ideational fluency
7. Associational fluency
8. Closure

Similar work was carried on at the Pennsylvania State University by Brittain (1954) and Lowenfeld and Beittel (1959) which

resulted in the identification of similar factors, as shown below:

Penn State Study	Guilford
1. Flexibility	1. Spontaneous flexibility
2. Closure and Intuition	2. Closure
3. Novel and original ideas	3. Originality
4. Sensitivity to problems	4. Sensitivity to problems
5. Fluency of ideas	5. Ideational fluency
6. Ability to see differences and similarities	6. Associational fluency
7. Ability to rearrange and organize	7. Redefinition
8. Ability to think abstractly	8. Adaptive flexibility

It is upon these identified factors that the bulk of the subsequent work in creativity has been built, particularly the efforts to measure creative thinking abilities. In addition to the foregoing list, a number of investigators (Guilford, 1967; Torrance, 1962) have added "elaboration."

From these factors, little can be implied as to specific product characteristics or qualities beyond the factors of originality and elaboration. Most of the factors are thinking abilities which are measured as they relate to a number of products or outcomes collectively produced, i.e., fluency, flexibility, etc. A single product cannot possess such qualities or characteristics except when viewed in relation to other products.

Furthermore, in the existing literature the identified characteristics of creative thinking have been dealt with almost exclusively on a quantitative basis. For example, originality is thought of in terms of the statistical infrequency of the occurrence of a response rather than giving consideration to the qualitative characteristics which make it an original response. Granted, its uniqueness or cleverness may be looked upon as qualities; however, they are generalized qualities. There must exist other, more specific qualities which would be appropriate for creative products in various areas of endeavor such as the arts, the sciences, etc.

From time to time, there has been discussion in the literature of the need for research related specifically and directly to the creative product. Gamble (1959), Taylor (1961) and Brodgen and Sprecher (1964) have advocated in their writings that creativity should be studied from a product-centered orientation. The work of Jackson and Messick (1965) has gone further and argued that creativity can be assumed through an analysis of the properties of the creative product. McPherson (1964) presented a plan for establishing ultimate criteria for measuring creative output in the sciences in which he proposed that "a searching analysis be made of all the creative products produced by the scientist and a summation made." In the same publication, Ghiselin (1964) discussed the ultimate criteria for two levels of creativity while Harmon (1964) talked about the development of criteria of scientific competence. Although

there has been much discussion concerning the need for research related to the creative product and some projected methodologies for attacking the problem, there has been little research related to the problem.

Johnson and his associates (1970) at CEMREL surveyed the field by reviewing and indexing research in creativity between 1900 and 1968 which was relevant to aesthetic education. In studying their KWIC (Key Words in Context) Index, one finds only one research study (Skager, Schultz, and Klein, 1966) dealing specifically with creative products and it was a judgmental study related to a group of experts and non-experts evaluating creative, artistic products.

In rather extensive and longitudinal surveys of the existing research related to the visual arts (Davis, 1961; Davis, 1971), this reviewer failed to uncover any substantial research which reveals insights into the characteristics or qualities of the creative artistic product. This concern has been around in the arts for some time. In 1928, Thomas Munro stated: "There is no obstacle but the inertia of tradition to prevent aesthetics from undertaking an extensive program of direct comparative observation of particular examples from the various arts, with the aim of discovering common and divergent qualities of form." Unfortunately, his statement prompted little activity among his colleagues or those who have followed. In the work that does exist, which attempts to analyze certain aspects of art products, it has almost always focused on the identification and

quantification of isolated dimensions rather than upon more generalized phenomena. Rouse (1968) did develop a descriptive scale for art products which was composed of twenty items. Lewis and Hussen (1969) worked from Rouse's scale to develop an instrument for evaluating children's artistic creativity by evaluating their art products. Their scale was comprised of 13 items.

While these latter two efforts have moved closer to identifying qualities in the visual arts product which are creation, they still seem to be dealing at a level of generality which is not very useful for instructional purposes.

The most useful research related to the problem of identifying the characteristics of the creative product seems to be that of Barkan, Chapman and Kern (1970). Taking a descriptive approach and working with substantive experts from the various arts areas, they delineated as a part of their guidelines for curriculum development in aesthetics the general characteristics of art forms, functions of art forms, and sensuous qualities of art forms at a level of specificity which seems to be important for instructional programs. With the general characteristics of art forms, they provide "an organization designed to suggest relationships among elements in the art form," with four subdivisions: media, structure, subject matter and theme, and style and idiom. The function of art forms category lists purposes for which a work of art might be created and the sensuous qualities category is concerned with "the qualities associated with uses of a medium which are perceived through the senses -- seeing, hearing, tasting, touching and smelling."

Research Needed to Advance the Area

To get beyond a generalized quantitative level in our work with creative products demands some very extensive descriptive research in specific areas of disciplines. Many areas of creative endeavor need to attend to describing in a detailed way the characteristics of the phenomena with which they are concerned at a level of specificity similar to that which Barkan, Chapman and Kern did in the arts areas of music, theater, dance, literature and the visual arts. With this accomplished, we might then be in a position to look across diverse areas and disciplines such as science and the arts and determine if there are, indeed, common characteristics or qualities in the creative products which are produced in the respective areas.

In the opinion of this reviewer the greatest research need in the area is a descriptive one which would lead to the delineation of criteria for determining the characteristics or qualities of creative products in specific areas and the subsequent of specific examples of such qualities. They will obviously vary from area to area. Once the characteristics are delineated for specific areas, we can then analyze them for similarities or generalizable elements. As evidenced by the existing literature or the lack of it, the generalizable approach which has been reasonably successful in researching the human dimension of creativity has not enjoyed the same success in researching the phenomena or product dimension of creativity. The need is clear for a beginning at the grass roots level.

Theoretical Issues Involved

In addressing the problem of identifying the characteristics or qualities of creative products as they relate to educational practice, we are confronted with several theoretical concerns which deserve attention here.

In our discussion on the creative product, it is critical to consider the degree to which the characteristics must be specified and the degree to which they are generalizable from one type of product to another. For example, are the characteristics of the creative scientific product the same as those of the creative artistic product or some other creative product? Are generalizations such as originality or the uniqueness of response really useful in learning?

From the beginning of the sustained studies in creative thinking in the 1950's we have been working on the assumption that the characteristics of the creative person and the characteristics of the creative thinking processes are generalizable from one area to another. However, there is not much convincing evidence to support this position.

General characteristics of the creative thinking abilities, such as fluency, flexibility and elaboration and their subsequent implications for the creative personality have been useful at a generalizable level. However, it appears doubtful that they are applicable to the same degree when we think of the characteristics of the creative product at a level of

specificity which is necessary for educational usefulness, namely, the identification of the critical properties of the phenomena which students will perceive and with which they will interact to learn.

Intertwined with the generalizability issue is a second major theoretical issue which concerns itself with the degree to which the product is reflective of the process. More precisely, how accurately and to what extent does the creative product reflect the process of producing the product? This becomes a concern of significant proportion when we consider the fact that most of the existing research is concerned with the process rather than the product. As indicated above, the existing literature would suggest that experts in the field assume a close relationship between the two since the studies of the process are based upon the products or outputs as tangible evidence of the internal process. In actuality, what is implied is that the process is an internal or covert response while the product is an overt or external expression of that internal response.

It seems extremely important for the purposes of this paper and for educational purposes in general, to realize that the overt expression or creative product is, at best, only an indication of the process or the internal response. Thus, it becomes critical to determine the degree to which the overt expression reflects the internal response. The relationship is obviously not absolute and the problem of determining the

observable expression and the qualities or characteristics of those expressions becomes a perplexing one. If, indeed, the overt expressions of internal responses exist on a probability continuum ranging from high to low, the specific position of a given expression carries with it an inference factor. The positioning of expressions on a probability continuum is a critical concern in such a position and demands careful thought and planning.

Methodological Issues Involved

The development of an orderly process or a set of procedures for dealing with some of the issues raised herein is a critical issue. Within the context of the theory of learning underlying this paper, I would like to deal with some methodological considerations related to the issues of identifying creative behavior and products and delimiting their critical properties.

As stated earlier, the creative process and, in reality, the creative product are internal responses or behaviors and can only be dealt with in an educational context when we have identified overt expressions of the covert responses. That is, only when we have observable behavior can we deal with the issues related to learning or changing that behavior. In recent years we have put great emphasis upon and made great claims in all of education about what we are doing to change the creative behavior of individuals. While this is a noteworthy desire,

we must necessarily be in a defensible position when such claims are professed. Too often we have resorted to ambiguous statements or gross generalities when we talk about changing the creative behavior and the creative output of children. The identification of tangible, observable behavior and products has been and continues to be a perplexing and harassing problem for educators. The problem has been reaffirmed with the increased emphasis in the past five years upon behavioral objectives and their ultimate implications for learning.

One of the major traps that has been set for education in dealing with this problem has been a format one. We have been led to believe that there is only one acceptable format for a behavioral objective, namely that of Mager's (1962). I believe that we have overlooked a far more pressing issue in the process; that of identifying educationally relevant behaviors. If, indeed, some of these educationally relevant behaviors deal with the creative domain and the production of creative products, we are confronted with the problem of identifying output which is indicative of the behavioral change we are attempting to effect. In fact, we are faced with identifying creative products which can be used as evidence of the change.

A useful device or methodology developed and used in curriculum development efforts in the arts (Davis, 1971) utilizes the notion that human behavior can be of two basic types: (1) overt or external behavior and (2) covert or internal response. Most of our concern with effecting change in creative behavior falls

into the latter category. In regards to such matters, there is frequently little agreement among substantive specialists as to absolute overt expressions of the internal response. While unanimous agreement will never be possible, it is probably not necessary. What is necessary is an individual commitment to overt expressions of the internal responses. Educators might be amazed at the similarity of agreement among their views if they would only make individual commitments.

In making such commitments, it seems helpful to think of the overt expression of the covert or internal response as existing on a probability continuum from high to low. In this way, one can determine and state subjectively the probability of a specific overt expression being indicative of a given internal response on the basis of his expertise and experience in the field. In such endeavors an inference factor comes into play. When one determines that an overt expression has a high probability of expressing the internal response, he is saying that it is a low inference expression. That is, not much inference has to be drawn between the internal response and the overt expression. On the contrary, when one determines that the overt expression is a low probability indicator of a given internal response, he is saying that it is a high inference expression. A great deal of inference has to be drawn between the response and the expression. While the goal is obviously to identify as many high probability/low inference indicators as possible, common sense forces us to realize that in an area

such as creative thinking, we will necessarily be dealing with many low probability/high inference indicators.

Once the behaviors and/or products are identified, one can then attend to the problem of establishing criteria for more or less acceptable responses. With criteria established, the basis for evaluating instructional efforts is formulated and the problem becomes one of selecting or inventing an appropriate methodology.

The learning model underlying this paper places a great emphasis upon the phenomena to be perceived by the learner. To present ambiguous phenomena for perception and subsequent conceptual development is only confusing and frustrating to the learner. Thus, educators must attend to delineating the critical properties of creative products and selecting appropriate examples for instructional purposes. Such a task cannot be performed in a generalizable way at a level of specificity that is educationally useful. While the identification of general characteristics of creative products both singly and collectively has been useful, it has been more appropriate for dealing with the quantitative aspects of the situation rather than the qualitative aspects. We must not be content to talk about originality in products, for example, at a generalized level. For educational purposes, we must talk about originality as it relates to creative products and be prepared to identify examples of originality as a characteristic of creative products as it relates to unique qualities or dimensions in a field. For example,

visual artists must think of originality as it relates to aesthetic organizing.

To delineate characteristics of creative products at this level is a discipline oriented task which must be dealt with in specific areas of endeavor such as art, science, business and the like. It is a task which demands the serious and concentrated efforts of substantive specialists in the respective areas. An example of an approach to the problem is the work done by Barkan, Chapman and Kern (1970) for the Aesthetic Education Program at CEMREL. They delineated specific qualities in dance, theatre, literature, music and the visual arts which centered around three basic product categories: (1) general characteristics of art forms, (2) functions of art forms and (3) sensuous qualities of art forms.

Contributions to Knowledge and to Applications of Psychology Expected

If, indeed, we can accomplish some of the tasks delineated in this paper to the characteristics of the creative product, we would be strides ahead in developing meaningful curriculum and instructional sequences for the development of creative thinking in learners of all ages. Assuming that the development of creative thinking and the production of creative products is a desired expectation of education, then we must deal with identifying and delineating those behaviors which are to be developed or modified in order to achieve such a goal. Subsequently, we must identify the critical properties of the phenomena

with which the individual will interact to bring about the desired behavioral change.

The already existing knowledge about the human behaviors involved in creative thinking which have resulted from the extensive studies of the creative personality, creative thinking abilities, etc. could be used in conjunction with the critical properties of the creative product (phenomenon behavior) to serve as a meaningful basis for learning to take place.

It appears that this is one of the most critical needs facing education today. With such a base of operation, educators are in a prime position for developing instructional materials that will assist the learner in setting and achieving realistic and obtainable goals. In the past, we have too often expected the learner to create in a vacuum without benefit of the knowledge of what they are expected to do or to produce. Such a position does not, in this reviewer's opinion, predetermine the exact specifics of the output. Rather, it provides a frame of reference for production and utilizes well selected samples for the acquisition of <u>necessary</u> conceptual understanding essential to completing the task.

The need for such well-developed and well-tested instructional materials is one of the most pressing needs of education today, particularly materials that lead toward individualized learning. With such materials, learning becomes an on-going process of the individual both in and out of school. These materials must be based upon descriptive research of the type

delineated in this paper. To develop more instructional materials without such a base of operation may be only an exercist in futility.

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V. CHARACTERISTICS OF THE CREATIVE SITUATION-- SHORT AND LONG TERM SITUATIONAL FACTORS CONTRIBUTING TO CREATIVE PERFORMANCE

Nicholas C. Aliotti
State University of New York at Albany

The creative situation can be conceptualized in terms of Rhodes' (1961) four types of definition: (a) person, (b) product(s) as embodiment of ideas, (c) process, and (d) press, the interaction between the person and his environment. The focus of this paper will consider the creative situation as the simultaneous interplay between process and press and its resultant impact on the creative performance of the individual.

In researching the creative situation it is possible to draw evidence from two primary sources of data. First, retrospective and current accounts of the creative behavior of individuals deemed highly creative by some appropriate social criteria and secondly, empirical investigations conducted in field or laboratory settings in which creative performance is operationally defined and variables effecting this performance are considered. The former approach, for example, has found expression in the work of MacKinnon and his associates at the Institute for Personality Assessment and Research of the University of California. The life history and test performance of creative writers, architects, and mathematicians were intensively studied in this approach. The latter approach is typical of such researchers as Torrance, Maddi, Wallach and Kogan, Maltzman, and others. Both approaches provide important insights leading

to further hypothesis testing and a subsequent retooling of our understanding of creative behavior.

The creative situation can also be differentiated along a time continuum representing those characteristics of the creative situation which impinge upon the individual for relatively brief periods and those long-term characteristics that are relatively stable within the individual and endure over time. Specific mental states such as those achieved with various "warm-up" techniques are an example of short-term characteristics of the creative situation contributing to creative behavior. In contrast, the development of sexual identity represents a long-term characteristic of the creative situation which may be thought to effect creative performance during the creator's life span.

In reviewing the short- and long-term characteristics, it will be necessary to consider both the kind of creative behavior that is determined by the high value society places upon it and the personal or norm-referenced creative behavior operationally defined by recently developed tests of creative thinking (Torrance, 1966; Guilford, 1967; Wallach and Kogan, 1965; Khatena, 1970). Issues related to these instruments have been considered by Treffinger in the present document.

RELEVANT LITERATURE

A substantial part of the literature on creativity has considered environmental factors and their impact on creative

functioning. Hopefully, the present decade will witness a distillation of these research findings and their implementation in education and industry. Recent review of the factors which effect creative functioning may be found in a variety of sources (Torrance, 1965; Christie, 1970; Wolfe, 1969; Taylor, 1972; McPherson (In Taylor, 1964); and Alamshah, 1967). The review which follows will consider those short- and long-term characteristics of the creative situation which seem to hold the greatest promise for understanding the more salient factors contributing to creative behavior.

ENVIRONMENT

The issue concerning what constitutes a suitable environment for creativity has led to a spirited controversy. Mackler and Shontz (1965), for example, concluded that creativity is an individually stable characteristic that is systematically sensitive to environmental circumstances. Torrance has flatly denied that one's creativeness will "win out," and has gathered considerable research evidence which strongly suggests that environmental climate can play an important part in creative expression (Torrance, 1965). Maddi (1965) has criticized theories of creativity which suggest that restrictive environments and/or states of long frustration work against creativity. According to Maddi, two motives: need for quality and need for novelty plus appropriate talents will lead to creativity.

A provocative description of creative expression under unusual circumstances is provided in Ketchum's book,

Ruhleben: A Prison Society (Torrance, 1967). This book describes the creative productions of 4,000 Englishmen who were detained for several years in a German concentration camp near Berlin throughout World War I. The quantity and quality of the creative productions of these men was truly astounding. One of the more interesting hypotheses offered by Ketchum to explain the creativity of the Ruhleben society suggests that through the shock of internment the inhabitants of Ruhleben were "reborn." That is, established habits were broken down and new "fluid and plastic" behavior patterns emerged. Other explanations offered by Ketchum include the high degree of freedom actually experienced by the Ruhleben inhabitants, the absence of women, the diversity of the population, and the transforming effects of organization.

FREEDOM FROM THREAT OF EVALUATION

The importance of freedom and psychological safety has been stressed by several researchers (Torrance, 1965, 1970a; Rogers, 1969; and Moustakas, 1967). Torrance (1965, 1970a), for example, has proposed that freedom from inhibiting sets and threats of evaluation seems to be particularly important in the early stages of the creative process (Osborn, 1953; Gordon, 1961). It enhances the individual's ability to think beyond the obvious and the familiar and results in an increased awareness of certain areas of experience.

Roger's (1969) conceptualization of freedom from threat of evaluation has stressed psychological safety, an acceptance of

the unconditional worth of the individual. Osborn (1953) stressed freedom from threat of evaluation in the problem solving technique known as brainstorming. The basic premise of brainstorming is that the deferment of critical judgment and the spontaneous presentation to other members of the group of any ideas that might occur to the participants would facilitate divergent thinking and result in problem solutions. While early experimental studies of this technique at Yale University (Taylor, 1958) demonstrated little superiority of the group brainstorming over individual brainstorming technique, recent evidence by Bouchard (1971) suggests that significant results can be achieved with the proper manipulation of certain variables. This point will be elaborated in a later portion of this paper.

To summarize, two complementary processes are evident: one, a pervasive respect for the individual and his ideational productions, and two, a willingness to defer evaluation and reality testing of these productions to some later time. A number of studies have investigated this generalized hypothesis in terms of assessment contexts, warm-up, instructional sets and the like.

ASSESSMENT CONTEXTS

The Wallach-Kogan study (1965), despite its theoretical deficiencies (Cronbach, 1968; Guilford, 1972), stimulated a number of studies of the role of assessment contexts on the measurement of creative thinking abilities. The basic premise was simple. If the assessment context provided for a warm,

permissive, game-like atmosphere, a creativity dimension defined by high inter-test correlations and separate from an intelligence dimension would emerge. Thus, Wallach and Kogan (1965) concluded that a serious limitation of recent attempts to measure creativity was the employment of constricting administration procedures such as time limits, a test atmosphere, and other stresses.

Using a play-like atmosphere and no time limits Wallach and Kogan (1965) found that creativity, defined as the ability to produce many associates and many that are unique, was independent of intelligence as assessed by traditional methods.

Following the lead of Wallach and Kogan (1965), Boersma and O'Bryan (1965) argued that a unified dimension of creativity separate from intelligence would appear in a testing situation relatively free from the coercion of time limits and knowledge that behavior is being evaluated. It was also surmised that an uninhibited, unschool-like atmosphere would result in an increased level of creativity and it was further expected that the relationship between intelligence and creativity would decrease under this condition.

Forty-six Canadian boys in the fourth grade were randomly assigned to two equal groups. All students were administered the Lorge-Thorndike Nonverbal Intelligence (NVI) and Verbal Intelligence (VI) tests under a standardized condition of classroom testing. One day later group A was tested by Examiner I in the school gymnasium with Torrance's (1963) Figure Completion test of Nonverbal Creativity (NVC) and Unusual Uses test of

Verbal Creativity (VC). One day later boys in Group B were informed they were free from school for the morning, invited to visit a place in the city, and taken, unaccompanied, by taxi to a university gymnasium. There they were met by a casually dressed individual (Examiner 1) who invited the boys to join him in the gymnasium where boxes containing sports equipment awaited them. After unrestricted play for 60 minutes, the examiner casually produced paper and pencils and invited the boys to try their hand at "a thing someone made up" (Torrance Figure Completion Test). A standard set of instructions was used. At the end of 10 minutes the boys were invited to visit the swimming pool. On returning from the pool the boys were allowed to play with the toys until 25 minutes separated the administration of the two tests. The boys were then encouraged to list different uses for a soft toy dog.

Boys in Group B scored significantly higher than Group A ($p<.01$) on both the nonverbal and verbal creativity tests. No significant differences were found between the groups on nonverbal and verbal intelligence measures. Furthermore, inspection of the correlation coefficients between measures of intelligence and creativity revealed that the relationships between these measures were markedly reduced in Group B. Boersma and O'Bryan concluded that under preconditions free from evaluation and in a group-testing format, the data support Wallach and Kogan's position.

Ward (1968) administered measures of divergent thinking to 34 seven- and eight-year-olds in a permissive context and without

time limits. Utilizing procedures of Wallach and Kogan (1965), rapport was established on several days and only when the children were ready were they invited to "play games." The "games" consisted of the Uses Test and a version of Wallach and Kogan's Pattern Meanings and were administered under conditions of liberal praise and encouragement. While no direct test was made of the importance of a permissive assessment context, correlational data indicated that ideational fluency was independent of an index of thinking defined by Block Designs, Object Assembly, and the Peabody Picture Vocabulary Test. A second study employing 87 kindergartern children did not result in a clear separation of the intelligence and creativity measures.

The differential effects of assessment contexts was the subject of Sherwood's (1968) doctoral dissertation. Eighty sixth-grade boys were equally divided between two assessment contexts and administered Wallach-Kogan type tests calling for alternate uses of objects, instances of verbally specified class concepts, and possible meanings of linear abstractions. In the test-oriented condition the experimenter referred to the tasks as tests, made references to timing, prominently displayed a stopwatch, and provided contextual remarks consistent with procedures associated with intelligence and achievement testing. In the other conditions, the experimenter introduced himself as a person interested in determining what games children were interested in, described the tasks as games, avoided any mention of time pressure, and in general induced a relaxed atmosphere. Tasks

were individually administered and time limits were not employed in either condition. Regardless of assessment context, the creativity measures were substantially intercorrelated and independent of the scores obtained on a group administered Lorge-Thorndike Intelligence Test. Neither the restrictive nor the permissive assessment contexts effected ideational fluency.

A highly related study (Kogan & Morgan, 1969), employed 52 male and 52 female fifth grade children. Wallach-Kogan tasks calling for the meaning of abstract patterns and the uses of named objects were administered to members of each sex. One half of the children completed the tasks under a test-like context while the remaining children worked under a game-like context. The former condition involved a presumed representative of the school superintendent who introduced the tasks as ability tests and prominently displayed a clock for timing. The latter situation presented a presumed representative of a toy company who introduced the tasks as games. In contrast to the Sherwood study test administration occurred in the classroom and both conditions involved time limits. The predicted superiority of the gamelike assessment context did not obtain; in fact, the test-like context resulted in significantly higher performances for the number and uniqueness of responses in the case of alternate uses. Results of the pattern meaning tasks and the spontaneous flexibility measures did not result in any clear-cut differences. Sex, anxiety, defensiveness, and type of task had varied effects of the creativity measures. Kogan and Morgan (1969) attributed

this discrepancy to the distinctive intrinsic properties of the two creativity tasks. Thus, the alternate-uses task, it was argued, facilitates the "proliferation of category exemplars," a condition which was not found in the experimental procedures of this study. Presenting slides of abstract designs (pattern meanings) in three different positions would hardly lead to the type of manipulation of the test materials conducive to ideational fluency. Such a presentation would appear to inhibit both the fluency and the uniqueness of responding.

An additional test of the Wallach-Kogan hypothesis is reported in Edwards' doctoral dissertation (Edwards, 1970). Two assessment contexts described by Edwards as permissive and non-permissive testing conditions were compared. (A more accurate description is an evaluated versus a non-evaluated condition.) Edwards administered the Uses Test to 131 urban sixth-grade pupils under the following conditions: a) the giving of grades vs. no grades; and b) individual vs. group administration of the task. The grades condition was significantly associated with total, unique, and non-unique uses and with longer on-task work times especially when considered with the group condition. The group condition resulted in significantly more non-unique responses and total on-task performance. Edwards noted that the group testing condition was less cumbersome and more typical of the classroom environment. He also suggested that the longer work times associated with the group condition may have resulted from the inherent anonynimity of this procedure and the absence

of social pressure, as possible inhibiting factor of the individual administration.

A issue somewhat related to assessment contexts has been reported by Ward (1969). Ward observed that during creativity testing children often scanned the immediate environment for cues to possible problem solution. For example, when asked to name round things, children offered such instances as "door knob" and "watch." The author has observed similar phenomena in a variety of creativity testing sessions and it may be considered a common observation. On the basis of test performance on the Uses and Patterns tests 53 nursery school children were divided into creative and uncreative subjects. Approximately two and one half months later, half of each group were administered the Instances test (naming instances of round things, soft things, and red things) in either a cue-poor or cue-rich environment. The cue-poor condition consisted of a typically barren experimental room while children in the cue-rich environment were tested in a room containing a table with numerous round, soft, and red things and colored posters. The main effects of creativity level ($p<.05$) but not environment and intelligence were significant. However, previously identified creative performers were again creative performers ($p<.05$). A significant interaction between creativity and environmental richness ($p<.01$) was obtained for fluency in naming instances. Ward suggested that one of the strategies of the creative child was to scan the environment for task-relevant information.

Mohan and Gupta (1972) recently extended Ward's (1969) study of the influence of cue-rich and cue-poor environment on creativity test performance. Verbal Form B of the Torrance Tests of Creative Thinking was administered to 64 Canadian fifth-graders. The effects of environment (cue-rich and cue-poor), creativity level (high and low peer and teacher nominations) and intelligence (children above and below the mean) on creativity test performance were investigated by a 2 x 2 x 2 analysis of variance. The main effects of environment and creativity level were significant as well as the environment x creativity level interaction. The cue-rich environment resulted in a significantly higher mean on the combined creativity test criterion (134.40 versus 87.15). The test performance of the high-creative students was more positively influenced by the cue-rich environment than was the test performance of the low-creative students. Mohan and Gupta have suggested that high-creative students use scanning as an additional strategy in creative problem-solving.

Researchers who have administered creativity tests in schools have often observed that situational events preceding testing greatly influence performance. Elkind et al. (1970) examined this observation by administering Wallach-Kogan creativity tasks (Class Concepts, Alternate Uses, Similarities) to 32 children between the ages of 5 and 12 under two conditions: once when they were involved in an "uninteresting" activity and a second time when they were involved in an "interesting" activity. Leaving an "uninteresting" activity prior to the administration of

the creativity tasks resulted in significantly higher scores than leaving an "interesting" activity on all tasks ($F = 51.56$, $p<.01$). The findings were consistent across age, sex, and ethnicity variables.

This study underscores the importance of motivational context effects on creativity test performance. Not surprisingly similar data have been reported by Burt and Williamson (1962) and Zigler and Butterfield (1968) for other tests. However, creativity tests may be even more sensitive to situational events than traditional tests of intelligence and achievement since they require originality responding rather than practiced, overlearned responding.

Aliotti (1969) investigated the effects of warm-up activities on the verbal creative thinking abilities of 96 Black first grade children. Two identical studies were completed in two schools. A post test-only control group design was employed and children were randomly assigned to each condition. On the first day children assigned to the Control situation were individually administered Verbal Form B of the Torrance Tests of Creative Thinking (Torrance, 1966) by a team of advanced graduate students. Meanwhile, children assigned to Condition Two (Physical Warm-Up and Language-Arts Warm-Up) participated in an identical 40-minute physical, non-verbal warm-up, stressing creative dramatics and role playing. To control for the interaction between the leader and his group, both leaders switched groups mid-way through the warm-up session. On the second day children assigned to Condition

Two were tested on the Torrance tests while the children in Condition Three participated in a language-arts warm-up consisting of encouraging questions, verbal expression, and verbal association to concrete stimuli. Restults of the statistical analyses revealed no significant differences among the treatment means for the summed verbal fluency, flexibility, and originality scores.

Apparently, the standard administration procedures of the Torrance tests were as effective as special warm-up procedures in facilitating performance on verbal creativity tests. However, there was a suggestion that the warm-up activities facilitated test performance in the second school. Experimental subjects surpassed the performance of their control mates by approximately one-half of a standard deviation. The respective treatment means for the control, experimental one, and experimental two conditions for fluency and originality were 30.80, 39.64, 43.95, and 15.30, 24.21, and 22.07. Two factors, large within-treatment variability and small sample sizes, apparently mitigated against the possible rejection of the basic hypotheses.

Nash (1971) conducted a replication utilizing a similar design. Providing warm-up immediately prior to testing resulted in significantly higher scores for a group of disadvantaged first grade children assessed on a figural form of the Torrance Tests of Creative Thinking.

An exploratory study by Hooper and Powell (1971) investigated the effects of musical warm-up on the figural elaboration and

originality scores of children and adults. First and third grade children and graduate students were subjected to the following conditions while completing the Torrance Picture Construction Task. Three experiments were conducted. Following Machlis (1963, p. 99) Hooper and Powell investigated the merits of absolute music "...which deals with musical patterns devoid of literary or pictoral connotations" and program music which carries associations lying outside the realm of tone..." A second hypothesis compared participation (use of rhythm instruments to accompany the music), motivation (request to listen carefully), and enjoyment (request to listen for enjoyment) conditions. The final hypothesis contrasted a live condition, an operatic aria sung live with piano accompaniment, with the same performance heard from a tape recording. Each subject was allowed ten minutes to work on the task, except for the third graders for the last hypothesis. A rank test was applied to test for significance. The absolute music condition resulted in higher elaboration scores at all grade levels and also for originality in the case of the third graders. Participation resulted in higher performance on the elaboration but not originality. Finally, live musical performance stimulated greater figural elaboration and originality scores.

Despite design limitations the study is interesting for a number of reasons. First, the warm-up effects were contiguous with the task performance. Secondly, treatment effects occurred across a wide age span. Finally, a cross-model type of warm-up was demonstrated.

ROLE OF INSTRUCTIONS

The effects of variations in instruction upon test performance on individual and group tests is well known. As early as 1957 Christensen found that in measuring creativity the wording and time limits significantly influenced performance. Some have interpreted these findings as underscoring the ephemeral and artificial nature of creativity tests. It has been suggested that the creative test performer is merely a glib or sophisticated test taker. What has not been recognized is the fact that such studies contribute to an understanding of the relationships between inputs and outputs in the creative process.

A second factor that has not been fully recognized is that individuals must be motivated to think creatively. The mental energy expended in creative thinking is substantial. In the development of the Torrance Tests of Creative Thinking (TTCT), for example, the author has been criticized for utilizing time limits and instructions which deliberately request creative thinking. What has not been recognized is the substantial research which attended to such questions during the development of these tests and the fact that they represent a considerable compromise between what could be considered ideal and what is reasonable and feasible for use in schools. A study recently completed at Purdue University reinforces this view.

Van Mondfrans, et al. (1969) tested the hypothesis that different methods of administration of divergent thinking tests would yield creativity indices with quantitatively and

qualitatively different characteristics. Four different testing procedures were employed in administering the TTCT to fifth, eighth, and eleventh grade school students. The first testing procedure (ST) consisted of the standard, timed testing procedures described in the tests manual (N = 109). Incubation (INC), a second method of testing, was induced with a 20-minute session four days before the tests were administered. Examples of creativity tasks were presented and subjects were given a notebook and told to write unusual or clever ideas as they occurred over the four-day period (N = 90). In the third method, take-home (TH) subjects were given the tests to keep for four days and told to work on them when they wished (N = 80). Finally, a fourth method sought to reproduce in abbreviated form a relaxed, playful, game-like atmosphere (WK) similar to that described by Wallach and Kogan's (1965) study reported in Modes of Thinking in Young Children (N = 77).

In summarizing their results the following conclusions of the researchers seem most pertinent to this review:

> ... The standard instructions (ST) for administering the Torrance Tests of Creative Thinking, as compared with the three other methods, result in higher scores on the verbal tasks with the males performing relatively better than females The take (TH) condition resulted in high scores on the figural tasks than the other three methods of testing with females out-performing the males.
>
> The relaxed, game-like atmosphere condition (WK) did not produce a unitary set of creativity scores and the correlations of creativity scores under this condition with IQ were not lower than the ST condition. In

> this condition (WK) the mean performances of subjects were lower than in the other conditions (p. 12).

COMPETITION

It is not clear if competition has played a significant role in real life creative attainment. Many eminently creative individuals appear to have high personal standards of excellence and the role of competition may be minimal. However, there have been occasions of intense competition among researchers. Empirical studies of competition have been studied in a variety of settings.

As part of a series of studies at the University of Minnesota, Torrance and Krishnaiah (1960) compared a set for competition against a "warm-up" experience in which children practiced on a toy fire truck before being asked to think of ideas for improving a toy dog. There was a tendency for children under the competitive condition to surpass the children under the "warm-up" conditions on the criterion task. Statistically significant results were obtained in the first, second, third, and fourth grades for fluency, flexibility, and fluency and flexibility, respectively. The investigators concluded that a "warm-up" experience compensates in part at least for lack of competition in the first four grades.

Competition, however, had a debilitating effect on the test performance of adolescents in a study by Adams (1968). Adams investigated the relative effects of three testing atmospheres

on the performance of ninth grade students on the spontaneous flexibility tests developed by Guilford (1952). Immediately preceding the administration of the post tests, Group One, the control group, received the standard instruction for the spontaneous flexibility tests. Group Two was subjected to an additional set of instructions to foster competition. Group Three received verbal information which stressed the conditions of freedom from competition. Finally, Group Four was subjected to additional instructions stressing conditions of freedom from competition and open receptivity to ideas. Analysis of the data supported the expected order of mean performances: Group Four, 49.75 (freedom from competition and open receptivity) highest performance; and Group Three 41.93 (freedom from competition); and Group Two 31.98 (competition) lowest performance. All differences were significant at better than the .05 level of confidence.

Raina (1971) reported two studies in India on the effect of competition on fluency and creativity. Raina and Chaturvedi (1968) and Raina (1960) demonstrated that competition affects ideational fluency and creativity favorably.

Alone or in Groups?

In recent years systematic investigations of the relative effectiveness of group and individual creative endeavors have received somewhat limited attention. The greatest impetus for group thinking has come from the brainstorming technique developed

by Osborn (1963) and his associates. A basic strategy of brainstorming recommends that individual group members spur each other on in creative ideation and "hitchhike" on one anothers' ideas. In fact, Osborn (1961) has claimed that about a third of the ideas produced in brainstorming are the result of "hitchhiking." Similarly, W. J. J. Gordon (1961) has maintained that the synectics method, a group technique which utilizes analogies to facilitate problem solution, is always superior to individual thinking. Groups are encouraged to engage in "irrational thinking" and to make the "strange familiar and the familiar strange."

Unfortunately, despite initial enthusiastic reception of brainstorming throughout the 1950's a study by Taylor and his associates in 1958 served to temper this enthusiasm, particularly in scientific circles. These researchers compared the number of unrepeated ideas generated by four individuals working alone with those working in groups and found that individuals alone could solve problems better than groups could brainstorming. According to Taylor the group conditions may have had the effect of channeling thinking in similar directions rather than facilitating variety and nonrepeated ideas.

Dunnette et al. (1963) reported results similar to those found by the Taylor study. Research scientists and advertising personnal worked in four-man groups and alone on four problems utilizing suspended judgment. Individual productivity was found to be superior in the alone condition; in fact, 30 percent greater in terms of quality, and without loss of quality. Among

the advertising personnel group interaction actually appeared to inhibit performance.

Bouchard (1971) investigated the roles of motivation, training, and competition with a research study designed to assess the effects of these variables singly and in combination. Groups had either worked together previously on a variety of problems, or had only worked on the criterion task. Motivation was induced by having pairs of groups compete against each other for a money prize. Finally, high and low interpersonal effectiveness groups were determined by personality test scores. Interestingly, Bouchard did not allow group members to interact spontaneously but rather had each group member participate in a sequential manner. No major effects due to motivation, training, or group composition were found. Bouchard's results underscore the high probability that interaction effects will obtain in studies of group production.

In all of these studies, however, the procedures for recording ideas were prejudiced against the group conditions. None of these investigators provided for multiple recorders as in groups trained in brainstorming and in experiments by Torrance (1970a).

Dyadic Creativity

Taking a cue from accounts of highly creative couples, Torrance (1970b) investigated the role of dyadic interaction in facilitating creativity. Five-year-old children and college

students were administered four tasks from the TTCT. It was hypothesized that dyadic interaction would facilitate the production of original ideas among individuals. Twenty college students were assessed under the standard conditions while twenty others were randomly assigned to dyads from the same population except that they were encouraged to "hitchhike" on one another's ideas but forbidden to repeat an idea produced by another. Forty-six five-year-olds were simultaneously assessed under the same two conditions. The results of both studies indicated that originality of thinking was facilitated by dyadic interaction, but the results were stronger for the college students.

Later, Torrance (1971b) replicated the foregoing experiment in three college classes with the same results with the additional finding of greater enjoyment in the dyadic condition.

Towell (1970) replicated the initial study with five-year-old disadvantaged children with similar results, and also found that persistence, as measured by length of time, was significantly greater in dyads than under standard conditions. Torrance (1969) had earlier also found evidence with five-year-old children that they were more willing to attempt difficult tasks when placed in pairs than when alone or before their entire class.

Additionally, there is strong evidence to suggest that highly creative adults and children are independent thinkers (MacKinnon, 1962; Torrance, 1959; Roe, 1952) and often are intensely involved in their work. There are a variety of instances, however, in which this independence in thinking can be channeled into

collaborative efforts. The highly creative individual, however, is often a minority of one and his new ideas may be disparaged and even ridiculed. In fact, other group members may see to it that his ideas do not receive serious attention, adoption or implementation. Torrance (1962) has noted that parents and teachers often feel threatened by the ideas expressed by creative children.

The individual proclivities of the creative individual would seem to be of primary importance with respect to determining the relative effectiveness of individual or group thinking in creative production. A variety of personality by treatments interactions would be expected on the basis of past researches.

TEACHERS, MENTORS AND PATRONS

Unquestionably the Italian Renaissance would qualify as a period of extraordinary creative achievement. In literature, painting, sculpture, architecture, engineering, astronomy, and other areas, artisans of every persuasion were busily engaged in creative behavior. Creative development among many citizens, particularly those who had demonstrated creative potential, was not left to chance. Many of these creative individuals were sponsored by local governments and principalities. Others worked as apprenticed artisans under truly outstanding teachers. The powerful deMedici family of Florence provides an excellent example of the role of a patron in the creative development of the individual. Even the most casual visitor to Florence is

overwhelmed with the amount of creative productivity which is evident in this city.

The proposition that creative development can be enhanced by individuals and institutions who function actively in support of creative behavior continues to be lauded. In discussing the role of outstanding teachers and their import for creativity in the sciences, Wiesner (1965) offered the following recommendation:

> The only time-tested formula for carrying out this process is that of associating the prospective scientist with a person who has demonstrated both the creative ability and the capacity to transfer his spirit to youngsters (p. 531).

A recent example of this formula was reported in the January 10, 1972 issue of Newsweek magazine. At age 18, Hunter Nicholas presented a research paper, "The Effects of Experimental Irradiation on the Anti-Bacterial Defense System of the Lung," at a meeting of clinical researchers and thus became the first pre-college student to present an original paper to this group. Nicholas' mentor, Gary Huber, chief of Harvard University's pulmonary unit at the Channing Laboratory for Infectious Diseases, recognized the severe limitation of conventional medical education and the unrecognized potential of young minds.

> It's a crazy way to train people. You usually put them into a lock step of learning by role during what ought to be their most creative period.

It is Huber's contention that "high school students can do useful, original research, even though their overall knowledge

of medicine may be limited." Huber's notions are still viewed as revolutionary despite Jablonski's (In Taylor, 1964) documentation of the creative research performance of public school children.

Witt (1968, 1971) initiated an experiment in New Haven, Connecticut, in 1965 which is continuing to this date. The role of mentors was instrumental in the creative development of the participant of this experiment. Sixteen lower-class Black children from the second through fourth grade of a ghetto were identified solely on the basis of Torrance tests and a test by Witt. Of the twelve who have continued with the program all have demonstrated outstanding creative achievement in such fields as music, art, science, and writing. In addition to providing for their families, the program provided these students with lessons in art, music, ballet, and other areas with outstanding teachers in the community.

MENTAL DISCIPLINE

Unfortunately, too often there has been a lack of recognition of the importance of mental discipline and the tremendous mental energy which accompanies the long term commitment to a creative endeavor. Frank Barron (1961, p. 9), for example, has contended that creativity requires an individual who is "willing to stake his life on the meaning of his work." Pavlov reportedly remarked that to carry on the work of creativity requires a "dedicated character."

Unfortunately, interest in creativity has also spawned some erroneous suppositions concerning the creative situation. It has been suggested, for example, that a danger exists in extolling creativity to the detriment of mental discipline and mastery of subject matter (Kneller, 1965). Such a suggestion would appear to deny the rather well documented fact that creativity is contingent, and in fact, highly dependent upon mental discipline and mastery of subject matter. MacKinnon (1962, p. 493) has observed that discipline and self-control are necessary.

Historically, there has been considerable warrant for this view. While a good fund of information is not sufficient in and of itself, it is a necessary prerequisite for creative ideation. Brain (1948), for example, has asserted that the genius excels ordinary men by virtue of the richness of his schemata or fund of information. Few of these assumptions, however, have been tested empirically. Ward's (1969) study on cue-rich environments, however, would lend tangential support for this hypothesis. Additional research supporting this view would help to dispel some of the awe and deference associated with creative productivity. It is quite possible, for example, to be the expert in a particular field and engage in considerable original research.

Long Problems

Torrance (1965, p. 296) states that almost all of the problems school children are confronted with require only a few minutes to solve. Despite the introduction of core curricula,

team teaching, and individual study, there is little evidence to suggest that this situation has improved significantly. As early as 1922 some educators recognized the value of long problems. Many problems may require a lifetime in order to unlock a solution. Boraas (1922, pp. 193-195) offered nine reasons for stimulating children to think about long problems. Breaking up big problems into smaller problems, opportunities for cooperative thinking, resolving conflicts of interest, suspension of judgment while the data are incomplete, and the accumulation of data under realistic conditions were among the reasons Boraas offered for stimulating children to think about long problems.

In working on a problem solution the creative person is likely to experience periods of both high and low levels of productivity. He may need to "regroup his forces," make an all out effort, and maintain an optimism in the midst of abundant failures. Thomas Edison, for example, was able early in his career, to reduce his daily sleeping time to five hours. His attempt to find a suitable filament for the first electric light bulb despite hundreds of failures is evidence for his unswerving and tenacious commitment to this problem.

Sustained Effort

The creative individual is often subject to personal intrapsychic states that impair his efficiency. Some researchers have considered these to be particular to the creative situation. Gowan (1968) has suggested that a "post partum" depression

sometimes occurs among creative individuals after creative but more mundane occurrences such as giving a public address. Gowan contends that at such a time the creative individual may feel that "the best has gone out of one" and that he is "spent." Gowan has offered some suggestions for managing the "post partum" depression. First, this aspect of the creative situation should be viewed as normal and not pathological. Secondly, descents from a peak creative experience are, in fact, likely to be disappointing. However, he suggests that the subsequent moodiness provides an acceptable manner of resolving the temporary loss of pleasure. Gowan also observed that creative behavior is not limited or spent once used, that a rest is natural after a creative effort, and that society may not at first value the creative product.

FAMILY DETERMINANTS

Contemporary personality theorists place an important value on the quality of one's childhood as a major determinant of personality development and life style. In particular, the study of family determinants has figured prominently in researchers' attempts to understand the creative personality and his creative thinking. Such basic consideration of the individual's personality make-up may be viewed as relatively stable phenomena whose effects may operate long after the experience of childhood and the immediacy of family have passed.

Studies of the family relationships of the creative individual have consisted of three basic research strategies. The

first, for example, consists of obtaining correlational data between child-rearing practices and creativity test scores. The second technique, which has been used less frequently, involves retrospective accounts of family determinants by adults distinguished by creative attainment (Roe, 1952; MacKinnon, 1962). Other researchers have surveyed autobiographical and biographical materials and included detailed accounts of the childhood and family life of creatively eminent individuals (Goertzel and Goertzel, 1962). Finally, Calvin Taylor and his associates at the University of Utah (Taylor & Ellison, 1967) have employed biographical information to predict various criterion measures of successful performance and attainments in science. The Biographical Inventory (BI) typically contains a wide variety of questions about childhood activities, experiences, sources of derived satisfactions and dissatisfactions, descriptions of the subjects, parents, and the like. Using this purely empirical approach, for example, Taylor and Ellison (1967) have reported an average cross validity coefficient of .55 in predicting an official overall rating criterion of scientific productivity.

Parent-child relationships have been found to be associated with performance on creativity tests. Getzels and Jackson (1962), for example, found that parents of less creative adolescents tended to be more vigilant and critical of their children than the parents of the more creative adolescents.

Nichols (1964) assessed the child-rearing attitudes of the mothers of 796 male and 450 female high school seniors with the

Parental Attitude Research Instrument. Authoritarian child-rearing attitudes of the mothers were negatively correlated to measures of creativity and originality of their children, but positively correlated to academic performance. Weisburg and Springer (1961) studied the personality and family patterns of highly creative preadolescents identified by the Torrance tests. The family units were found not to be overly close and not overly dependent upon one another for support. In addition, they were more likely to express strong feelings openly.

Orinstein (1961) investigated the mother's parental child-rearing attitudes and creativity in young children. Forty-five mothers completed the Parental Attitude Research Instrument (PARI), The Block Scale, Edwards' Social Desirability Scale, and a Personal Data Sheet. A measure of the creativity level of their second grade children was obtained with the Creativity Rating Scale, which assessed verbal (story telling) and nonverbal (clay) free expression. Significant positive correlations were found between restrictiveness and hostility on the PARI and creativity on the clay productions. Total creativity was also positively and significantly correlated with restrictiveness on the PARI.

Dreyer and Wells (1966) studied the relationship between parental values and controls and creativity in their children. A questionnaire dealing with spousal relationships was administered to the parents of 24 nursery school children enrolled in a university laboratory school. The Ask-and-Guess Test, Product Improvement, and Picture Construction Tests from the Minnesota

Tests of Creative Thinking were used to differentiate high and low creative children. Parents of the more creative children showed significantly more role tension. That is, they were more likely to report negative characteristics in themselves and their spouse. Moreover, they showed less consensus in family matters, suggesting a reinforcing of independence in thought and action, a characteristic of the creative child. Interestingly, the mothers of the creative children were less concerned with a place in the community and companionship and more concerned with everyday interests and emotional security. Despite the small sample size the study is provocative and should be replicated.

Capitalizing on the known differences in the degree to which Indian and American society expect normative conformity of children, Straus and Straus (1968) tested the hypothesis that children's creativity varied according to the degree to which the child's role in the family requires conformity. Families with male children and families with female children selected from parts of Minneapolis and Bombay were required to figure out how to play a game employing balls and pushers. A light panel provided feedback as to the correctness of the ideas offered by each faculty member. This "creativity" protocol was then scored for fluency and flexibility after the scoring system developed by Wilson, Guilford, and Christensen. In general, the scores of the American children were significantly higher than those of the Bombay children and the scores of males were significantly higher than the females. The authors interpreted the

results as "supporting the theory which holds that for a person to conform creatively he must be in a situation where originality, independence, or nonconformity are permitted by the roles of the culture and by previous learning (p. 32)."

With respect to sex differences, the authors interpret the lesser sex differences found in the American samples as a reflection of the greater freedom and individuality permitted girls in American society. However, one could also argue that males had available to them a larger repertoire of experiences involving games where objects are propelled by various objects.

Classroom and Climate Variables

To what extent does classroom environment or school climate effect creative expression? Torrance (1972) reviewed some 24 studies of teacher-classroom and climate variables concerned with children of all educational levels. The creative thinking abilities of teachers have not been shown to be associated with similar abilities among children in their classrooms. Torrance concluded that studies involving teacher-classroom and climate variables have not been successful in their attempts to teach creative thinking. Perhaps a clue to understanding this dilemma is found in the shallow nature of many studies. A study at Purdue University (Shively et al., 1971), for example, contrasted two creativity instructional programs: the Purdue Creativity Training Program and the Productive Training Program, high and low teacher creativity as measured by the Torrance Tests, and a

discussion and nondiscussion situation. A pre and post test control design was employed with pretest creativity measures as covariates. In such research designs three-way interactions often obtain making interpretation difficult, if not confounded. The results of this study are typical. Interactions were reported for each creativity variable measured. Classrooms of nonparticipating teachers did as well as or better than classrooms of creative teachers on the criterion measures.

In addition to questionable research designs, studies of teacher-classroom and climate variables have not received the support they deserve. Torrance (1972), for example, observed that most of these have been doctoral studies lacking a strong commitment from the school systems involved. Studies involving highly competent and seasoned individuals and in-service leadership have resulted in more promising findings (Soar, 1968; Clark and Trowbridge, 1971; and Mitchell, 1967, 1971).

In-service Education Programs

An in-service education program was utilized by the school personnel of the Goleta Union School District of California (Brown, 1968; Mitchell, 1971). This project involved a study of creativity as a psychological process, a personalization of the creativity concept with a focus on the development of a climate of psychological security, and a reintroduction of the first strategy, i.e., creativity as a psychological process. Room visitations, development of problem solving skills, and

explorations and self-evaluations relating to the creative process, sensitivity to students and colleagues, and the like, plus weekend retreats constituted some of the activities of the in-service programs. Based on these strategies Mitchell (1967) found that in-service programs facilitated the creative thinking abilities of elementary school children. Boys and girls in grades four, five, and six showed significant gains on the TTCT over their controlmates as determined by an analysis of covariance.

Teacher Self-Concepts

Trowbridge (1970) and Clark and Trowbridge (1971) have reported data which suggests that teacher self-concept may be related to creative thinking in the classroom. The context of the study was an in-service teacher education program. Among a sample of 292 elementary teachers and 47 secondary teachers who participated in the program substantial correlations obtained between teacher's self-concept (Tennessee Self-Concept Scale, Fitts, 1965) and the proportion of class time spent on the operations of divergent thinking (44.38), evaluative thinking (.51, .47), memory and cognition (-.40, -.47), convergent thinking (-.21, -.22) and routine (-.39, -.40).

Contrasted Classroom Climates

It has been stated by some educators that despite considerable efforts school classrooms in the United States are more

similar than dissimilar. Uniformity of curricula, texts, state laws, and the like mitigate against variety of teaching approaches.

Somewhat different circumstances have prevailed in other countries. Haddon and Lytton (1968) contrasted the creative thinking performances of eleven and twelve year olds from Formal and Informal primary schools in England. The Formal schools represented traditional schools which placed more emphasis on convergent thinking and learning from authority. In contrast, the Informal or progressive schools placed more emphasis upon self-initiated learning and creative activities. Some 211 children, matched for verbal reasoning quotient, in two Formal and two Informal schools were contrasted. A test battery which included figural and verbal creativity tasks after Torrance (1962) and a sociometric instrument were administered to the children within a few days of completing their primary education. Test results confirmed the main hypothesis of significantly higher scores being obtained from children in the Informal schools. Five of the six tasks were significant at the .05 level of confidence or better while the sixth task demonstrated results consistent with the main hypothesis. Lytton and Cotton (1969), however, were not able to replicate these findings at the secondary level. Nevertheless, the results of the Haddon and Lytton (1968) study are distinguished by the clarity of the superiority of children from the Informal schools.

SOME NEEDED RESEARCH

In reviewing the short and long term characteristics of the creative situation one is struck by the divergence of opinion regarding what may be called the "plasticity" of the creative process--the extent to which situational factors can play an important role in inhibiting or facilitating creative behavior. There has existed, particularly in the public's mind, the view that the creative process is inscrutable, ephemeral, and impossible to know. Unfortunately, this has served to impede the acquisition of knowledge regarding creative behavior. It has been viewed by many as a gift from on high which is necessarily undefinable. This may be likened to the view of "genius" which prevailed before the Terman studies.

At the other extreme, some researchers have speculated much beyond their data base concerning what we may know with any certainty regarding the facilitation or inhibition of creative thinking. Clearly, if anything is evident regarding truly creative behavior it is that it is indeed rare. By definition this is to be expected. For example, if we were to assume a trait theory approach to understanding the creative individuals we would expect that they would all be relatively high on such traits as independence in thinking, openness, originality of thought, etc. The way they will be different and unique will far outweigh their commonalities. Conversely, it is equally evident that individuals can be taught or motivated to behave more creatively in their lives, that is, to

significantly increase the operant level of their own personal creative behavior.

Assessment Contexts

Spurred on by Wallach and Kogan's study on assessment contexts (1965) a number of researchers conducted experiments to test two related hypotheses. The first suggested that creative performance would be higher under a relaxed, playful atmosphere. The second suggested that correlations of creativity scores obtained under these conditions would be orthogonal to traditional measures of intelligence and achievement. In retrospect it appears that important variables were being investigated for the wrong reasons, that is, to increase test performances and reduce correlations with IQ measures. The emphasis on playfulness at the expense of considerations of mental energy expended has fostered an additional error which has confounded this area of research.

The study by Ward (1969) suggests that research concerning environmental stimuli may provide some important clues as to how the creator and his environment interact during the creative process. Additional research concerning the genesis of creative ideas is called for.

Sequence and Transfer

Definitive experiments need to be conducted which would take into account the sequence or order effects of creative

thinking abilities in various school curriculums. Specifically, what is the transfer value of various kinds and sequences of training in creative thinking abilities and what particular aspects of the school curriculum are affected? As Guilford (1971) has suggested creative thinking skills may have more potency for learning at various points in time. Few researchers have addressed themselves in a systematic fashion to either the short or long term effects of transfer to school curricula. Guilford and Torrance, however, caution researchers not to expect transfer effects in view of the usual absence of requirements for creative thinking in the assessment of achievement.

Higher Contrast Groups

There is considerable need for in-depth analysis of the creative thinking abilities of selected sub-groups. MacKinnon's work with creative adults and Torrance's studies of pupils attending laboratory schools at the University of Minnesota represent notable examples. Such researches are expensive undertakings. However, a viable and necessary alternative is to investigate naturally occurring groups representing uniqueness in themselves. For example, researchers might investigate the creative thinking abilities of Transcendental Meditation Societies. Many such natural groups exist today on college and university campuses. Exciting research possibilities should obtain. However, since these groups attract individuals who are more likely to reflect characteristics associated with the

creative individual, care must be taken to obtain adequate control groups. A potential control group might comprise proponents of "bio-feedback."

Dyadic Creativity and Affect

Studies by Torrance (1971) on dyadic creativity suggest that important insights can be gained concerning creative processes by investigating the role of groupings. Torrance has reported that in contrast to individual test administrations when subjects were placed in dyads, their creative test performance and task enjoyment increased. In fact, affect variables may prove to be highly relevant short term characteristics which affect creative performance. Research which would undertake a systematic manipulation of affect variable is indicated.

Sex Differences

A number of questions remain concerning the differential effects of cross-sex identification patterns in men and women and what their implications might be for creative development. The zietgeist appears to be supportive of studies in this area. The majority of studies have concerned males and relatively little is known about cross-sex identification in females and its implication for their creative development. Helson's research (1966, 1967, 1968) has provided one of the few but significant contributions in this area. Intensive studies of the creative development of males and females is needed. Researchers would do well to examine sex differences systematically rather than as a post-hoc afterthought.

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VI. The Assessment of Creativity

Donald J. Treffinger
Department of Educational Psychology
and Measurement
University of Kansas

Although the volume of literature on creativity has increased very rapidly during the past 20 years, it is clear that many difficult problems remain unsolved. Central among the difficulties -- perhaps because of its pervasiveness -- is the issue of the assessment of creativity. How will we recognize creativity? Can we identify creative behavior and potential with any confidence and accuracy? By what standards will individual or group differences be described, or the effects of training programs documented? These are questions which, in their simplest form, say: "How can creativity be assessed?"

There are three initial assumptions which will be stated. The first two concern preliminary assumptions about how the term creativity will be used, and the third involves the term assessment.

Treffinger, Renzulli, and Feldhusen (1971, p. 105) stated the first two assumptions briefly:

> The first is that certain unique psychological processes, referred to as "creativity," do in fact exist in man's repertoire of behaviors, although in our investigation of those behaviors, we may have merely scratched the surface. The second assumption is that creative process is complex, or multidimensional, in nature.

The third is that "assessment" should be taken to mean any procedure which attempts to provide an objective description of a person's creative behavior or potential. There is, in this view, an emphasis on the role of measurement in psychological assessment, but the reader should not conclude that the paper will therefore be concerned only with "tests" of creativity. Assessment will be used, therefore, to describe the broad domain ("recognizing creativity"). Measurement will refer to specific procedures and techniques employed by the psychologist in assessing creativity. Testing is one such specific procedure.

In dealing with psychological assessment, three general categories will be used: validity, reliability, and usability. The paper will be organized into three sections, each corresponding to one of these categories. In each section, the following topics will be considered: recent literature, theoretical problems, methodological problems, and summary of implications for research needs.

This paper will not attempt to review exhaustively the literature pertaining to the controversies surrounding the adequacy of specific, existing tests of creativity, such as the Guilford tests, the Torrance tests, or the Remote Associates Test, since several other recent papers have conducted partial reviews of a number of tests (Tryk, 1968; Dellas and Geier, 1970; Crockenberg, 1972). Nor will this paper attempt to catalogue existing published and unpublished "tests" of creativity, since a similar project has recently been reported in the

Journal of Creative Behavior (see: 1968, volume 2, number 3; 1971, volume 5, numbers 2 and 3).

Validity

Of the several concerns in assessing creativity, perhaps none is more important, more urgent, but also more complex, than validity. The question of whether or not some measure of creativity "really" taps something that is genuinely "creativity" is probably the foremost concern of the researcher as well as the general audience. No psychological procedure, regardless of its stability, consistency, or ease and economy of use, is of much value unless there is some unequivocal evidence for its validity. No matter how well a test measures something, it is not useful until we can be reasonably (and scientifically) confident that the "something" is really what we were interested in.

It is customary among psychologists to describe three general ways in which the validity of a test can be documented. These are: content validity, criterion-related validity, and construct validity. Brief definitions of each may be useful; the following are from Anastasi (1968):

Content validity. "The systematic examination of the test content to determine whether it covers a representative sample of the behavior domain to be measured" (p. 100).

Criterion-related validity indicates "the effectiveness of a test in predicting an individual's behavior in specified situations" (p. 105). The criterion may be an immediate

criterion, in which case we usually discuss "concurrent" validity, or a long-term criterion, in which case we discuss "predictive" validity.

Construct validity involves the extent to which a test may be shown to measure a theoretical construct or trait; it requires the gradual accumulation of information from a variety of sources.

Many theoretical and methodological problems confront the creativity researcher in each of these three areas; thus, each area will be considered separately.

Content Validity

Theoretical Issues. Although traditionally associated with the measurement of achievement, problems of content validity also confront the creativity researcher. In order to argue for content validity, it is necessary to present evidence that one's test or assessment procedure samples in a representative manner the domain of concern. In measuring creativity, we are confronted immediately with a major problem: what is the universe from which we must sample? Without an adequately defined universe within which to sample, it seems virtually impossible to establish content validity for a creativity measure. Torrance (1966, p. 23) contended:

> ... (It) would be ridiculous even to try to develop a comprehensive battery of tests of creative thinking that would sample any kind of universe of creative thinking abilities. The author does not now believe that anyone can now specify the number and range of test tasks necessary to give a complete or even an adequate assessment of a person's potentialities for creative behavior.

There are several theoretical problems which have to do with the difficulty of establishing content validity for creativity measures. Treffinger, Renzulli, and Feldhusen (1971) contended that a major problem is that there is no single, generally-accepted theory of creativity which serves to unify or direct efforts at specifying assessment procedures.

In viewing the problem of content validity of creativity measures, another related issue concerns the complexity of creativity as a psychological construct. Does creativity represent a unitary psychological construct, comprised of a specific set of basic aptitudes and traits which are common across a variety of creative expressions? Or are there "many creativities", each comprised of a unique structure of aptitudes and traits? In the first case, the problem of establishing content validity focuses upon the adequacy with which we can define, and sample, the basic aptitudes and traits (cf., Guilford, 1971). In the latter case, however, the general term "creativity" may have actually been misleading, in that we have attempted to define and sample one universe rather than several (cf., Ausubel, 1963; Wallach and Kogan, 1965; Wallach, 1968).

It is possible that creativity may represent such a complex human phenomenon that we may never be able to represent it adequately as a single, unidimensional operational variable, or even as a small set of operations. For example, although Torrance (1966) has attempted to sample a wide range of creative abilities in his tests, he reported that he "would be the first

to admit, however, that these test tasks do not sample the entire universe of creative abilities" (1966, p. 24). There remains a clear challenge for contemporary students of creativity: to engage in significant theoretical work which may lead to improvements in our ability to define the universe of creative abilities, and subsequently to sample that universe more effectively in new measures.

Methodological Problems. Several methodological problems in measuring creativity are also related to the question of content validity. Covington (in press) argued that, in our attempts to develop measures of creativity that "fit" well into established psychometric approaches, we have often sacrificed some of the essential attributes of the creative act. He described several ways in which traditional psychometric techniques would seem to be unsuitable for assessing creativity, including:

1. Although the creative process is usually thought to involve deep personal commitment and involvement in a problem, traditional measurement procedures often rely on artificial, highly contrived situations. The test tasks do not often resemble the kinds of real problems in which a creative person might become involved.

2. Rather than allowing intense involvement in a single problem over a substantial period of time, conventional procedures usually involved timed, speeded performance on a large number of discrete items.

3. Although creative responses may not lend themselves to precise, objective evaluation, conventional measurement approaches stress standardized scoring procedures.

4. Conventional tests frequently stress unique, specific abilities, whereas the creative process involves the coordination, management, or integration of such abilities.

5. In conventional test situations, directions are clear and straightforward, whereas real problems which confront the creative thinker are complex, and are not usually well-ordered or defined for the person.

Guilford (1971) has also warned of common misconceptions that must be avoided in studying creative talent. He observed that creativity has too often been associated only with "divergent thinking," although he has argued strongly that many other aptitudes and traits are involved. The clear implication is that any operational definition of creativity which is restricted to divergent thinking cannot be content valid, since it is known to sample only a small portion of the abilities which contribute to creative talent. In addition, Guilford (1971) urged caution in modifying the timing, format, and directions of aptitude measures, in that such changes have commonly been shown to influence the nature of the aptitudes being measured. This suggests clearly that, in order to sample accurately a particular part of the universe of creative abilities, we must be cautious about the selection and use of test tasks. It also raises serious questions about the comparability, and perhaps directly about

the content validity, of studies in which experimenters do not report carefully the tasks selected, or in which tasks vary from study to study or are modified in some way by the experimenter.

Criterion-related Validity

Theoretical Issues. The greatest single problem in establishing criterion-related validity (either concurrent or predictive) is, of course, the selection of criteria. What are the external criteria against which measures of creativity may be validated?

There is, of course, great concern about the identification of acceptable criteria against which measures of creativity may be validated. This concern is not new; indeed, as one reads through the reports of many of the pioneering Utah conferences on creativity (Taylor, 1964ab), the striking impression created is that we still have with us, almost a decade later, the same fundamental problems with which the conference researchers grappled. Brogden and Sprecher (1964), in their essay on criteria for creativity, raised many still-familiar concerns: product-process distinctions; difficulties of identifying reliable criteria; problems of generalization and control variables.

Much current work has suffered because our theoretical understanding of the nature of creativity has been too limited. As Treffinger, Renzulli, and Feldhusen (1971) contended:

> Many researchers have tended, on the one hand, to view creativity entirely as a cognitive process, or, on the other hand, entirely

> as a complex set of personality traits. The former have tended to ignore the possibility that there may be an affective component to creativity, and the latter have tended to overlook the importance of underlying cognitive abilities .... It is most likely, however, that a valid assessment procedure would, of necessity, consider both components. (p. 108)

Establishing criteria for concurrent validity of creativity measures has also been difficult because of disagreement over a variety of specific issues: the evaluation of products, the possibility of determining process criteria, the question of novelty (for whom?), and the persistent criticism that "creativity" may in fact be used better to describe a rare quality or genius rather than a psychologically-distinct set of individual difference variables. Each of these problems cannot be reviewed in detail in this paper. However, it is clear that one's positions on these issues will determine to a rather great extent the suitability (or unsuitability) of various criteria proposed for the validation of creativity measures. Finally, in establishing criteria, much more must be known about the effects of a variety of control variables. Are different criteria needed for sexes, various age groups, or in different cultural settings?

In considering long-term studies of criterion-related validity (i.e., predictive validity) numerous additional questions are raised. Foremost, there is the need to conduct longitudinal studies of creative development over a substantial period of time, and involving large-scale psychological assessment. Although data presented by Torrance (1972ab), concerning

the predictive validity of the Torrance tests, are encouraging, and the results promising, much more extensive studies -- involving larger subject pools, longer time periods, and a wider variety of criteria and tests -- are still needed. The field of creativity research would profit greatly from the appearance of someone able to do what Terman's Genetic Studies of Genius did for the study of exceptional intelligence.

Methodological Problems. A variety of specific methodological issues relate to the problem of criterion-related validity.

First, it must be made clear that measures of creativity, as an extremely complex construct, will not be likely to be substantially validated against any single criterion. Guilford (1971), warning of the complexity of creative talent even within the domain of cognitive abilities, argues that no single aptitude factor (i.e., a measure of divergent thinking, for example) should be expected to yield high validity coefficients against complex external criteria. Because of the number and extent of aptitude factors involved in creative talent, it is unlikely that any small, relatively arbitrary selection of tests will predict well a complex, multidimensional criterion of creative behavior. Presumably, the same warning should apply to users of selected tasks from the Torrance Tests of Creative Thinking. This suggests, in addition to the need for broadening the selection of test tasks, the need to utilize complex multivariate statistical procedures rather than simple bivariate correlational procedures.

Next, increased attention must be given to the adequacy of the criteria themselves. New approaches to the identification of criteria and the sampling of complex behavior must be sought, which will lead more appropriate and reliable criterion assessments. Such techniques as critical incidents, behavioral analyses of creative acts, or programmed creative problem solving sequences (cf., Covington, in press) may hold promise for the collection of more adequate criterion data. In addition, current research on the development of new measures of cognitive abilities (Asher et al., 1971) and the structure of abilities involved in various complex cognitive tasks (Treffinger and Speedie, 1972) may provide new insights into the criterion problem.

Finally, as Guilford (1971) has also argued, it is necessary to examine carefully the variety of commonly-used criteria to evaluate their adequacy, and possibly identify improvements. This issue has been illustrated by consideration of problems in several commonly-employed criteria (teacher and peer judgments, creativity profiles, products as indices of creativity, problem-solving tasks, and measures of originality) by Treffinger, Renzulli, and Feldhusen (1971, pp. 108-110).

Theoretical Problems. There are several substantial theoretical problems which relate to establishing construct validity for measures of creativity. First, as French and Michael (1966) advance as essential for construct validation, evidence which purports to establish that a test is a measure of a theoretical variable (i.e., creativity), the interpretation must be fully

stated and distinguished from interpretations which would arise from other theories. In other words, it is the researcher's (or test developer's) responsibility to make clear the theoretical basis underlying the proposed measure. He must accept the responsibility to describe the theory, and the hypotheses derived from that theory, as completely as possible. He must show that the hypotheses and interpretations developed are distinguished from other theoretical constructs or interpretations. Such theoretical bases are frequently sadly lacking in studies of creativity and its assessment.

Furthermore, the research literature, although it has become voluminous in the last two decades, is not well-integrated, so that it is difficult to examine the possible alternatives of theoretical interpretation to which a given set of data may be open.

The problems of definition and criteria, which create problems in relation to content and criterion-related validity are also related to construct validity. Differences among writers concerning definitions and criteria lead to substantial difficulty in formulating testable hypotheses, or in documenting the theoretical or empirical rationale for certain hypotheses. This is further compounded by the fact that many research studies have employed widely-differing tasks (as in the area of problem-solving; cf., Davis, 1966) or varying sub-sets of tasks. Selection of sub-tests may imply that fundamentally different psychological processes are being assessed in each study, so the

problem of developing a consistent theoretical basis for the interpretation of results or derivation of new hypotheses is greatly increased.

Methodological Problems. Because of the complexity of assessing construct validity of creativity measures, there are many methodological problems, involving general concerns for construct validation, as well as some which relate to very specific issues. The two greatest problems appear to be: (1) the theoretical and empirical distinction between creativity and intelligence; and (2) the need for the development of experimental studies of creative behavior.

Creativity and Intelligence. A complete consideration of the creativity-intelligence question is beyond the scope of the present paper. A number of studies (e.g., Ripple and May, 1962; Thorndike, 1963; Wallach and Kogan, 1965) have cautioned against uncritical acceptance of the Getzels and Jackson (1962) hypothesis which suggested that creativity and intelligence were unrelated. Guilford (1967) has proposed that, given a full range of scores among both creativity and intelligence variables, the scatterplot for the bivariate distribution of scores would be triangular. That is, as the intelligence scores increased, the range of corresponding creativity scores would become wider. This appears consonant with the notion of MacKinnon (1962) and others that, in order for creativity to appear, a minimum intelligence is at least necessary, whereas, above that minimum, there is very little relationship between the two variables.

Wallach and Kogan (1965) and Wallach and Wing (1969) have demonstrated, however, that the accomplishments of students scoring high on one variable, but not the other, differ in many significant respects. This suggests that, even if (within a full distribution of scores on both variables) there may be a generally moderate, positive correlation between creativity and intelligence, there remains a sufficiently unique component of each variable so that marked differences in behavior may be identified.

This problem has not been fully resolved, however, and it is related in part to a broader theoretical problem. The researcher, as noted above, must assume the responsibility for stating fully his theoretical position and the interpretation of his data; in addition, he must distinguish the variables with which he is concerned from other constructs. It is certain that much of the controversy concerning the creativity-intelligence relationship is related to problems in the definition and theoretical interpretation of both creativity and intelligence. When "creativity" is defined, for example, by performance on a specific measure of divergent production, and "intelligence" by reference to performance on a specific IQ test, the theoretical prediction of the relationship may be more clearly stated than when we argue about the relationship between "creativity" and "intelligence" as general (but non-operational) constructs. Further, Guilford (1971) has cautioned that prediction of relationships among aptitudes is extremely difficult when the

actual abilities tapped by one measure are not empirically verified (as in Wallach and Kogan's "intelligence" measures). Guilford (1971) also points out that changing the nature of tests, timing, and directions (again, as in Wallach and Kogan's "creativity" measures) may alter markedly their construct validities. Similarly, Van Mondfrans et al. (1971) showed that differences in test scores resulted from a variety of modifications of timing and test administration procedures, and Feldhusen et al. (1971) found, with the same data, substantial differences among patterns of correlations with IQ and achievement criteria. Finally, Williams and Fleming (1969) presented evidence that some of the purported "independence" of creativity and intelligence measures, in the Wallach-Kogan approach to testing, may be artifacts of inter-test format differences.

A more complex reformulation of the creativity-intelligence question involves what has been called convergent-discriminant validation (Campbell and Fiske, 1959). Stated simply, the problem holds that measures of a certain construct should correlate highly with other measures of the same construct, but negligibly with measures of some different construct. Several measures which purport to assess "creativity" should, therefore, intercorrelate substantially (convergent validity), whereas they should yield low correlations with measures of some other, different construct (discriminant validity). Wallach and Kogan's (1965) criticism that tests of "creativity" often correlate as well or better with measures of IQ (presumably a different

construct) than they correlate among themselves illustrates such a concern. However, the problem is complex, and the Wallach-Kogan results have not always been supported (Williams and Fleming, 1969; Feldhusen et al., 1971). In addition, Guilford (1971) has argued that creative talent may be so complex that current measures of related aptitudes (such as divergent thinking) may well tap quite unique aspects of the construct, and so may not be expected to display high intercorrelations.

Beyond Simple Correlational Studies. It is also true that many studies of creativity and creativity measures have been simple correlational studies, from which only limited theoretical information may be obtained. From simple correlational studies, it is possible to describe the magnitude and direction of a relationship between the variables studied; the underlying cause(s) of such a relationship are not open to examination. Thus, in order to test adequately a full range of hypotheses concerning the nature and assessment of creativity, more complex research methodologies are needed. These include:

(a) use of multivariate statistical techniques, to allow for the investigation of the more complex multiple aptitudes which are involved in creative talent;

(b) the use of experimental and quasi-experimental research designs, including large-scale sampling of populations of interest, well-controlled studies, and replication studies;

(c) the development and implementation of longitudinal studies of creative talent.

Table 1 summarizes theoretical and methodological problems in determining the validity of creativity measures, and recommendations for needed research.

Reliability

Reliability, according to French and Michaels (1966), refers to "the accuracy (consistency and stability) of measurement by a test. (p. 25)" Since, however, there are a variety of sources of inaccuracy or "error" in the measurement of some psychological construct, there are several approaches to the determination of reliability.

The first approach inquires about the stability of test scores over a period of time; the usual approach to assessing stability is referred to as "test-retest" reliability. That is, in order to determine the stability of scores on a particular measure, one might retest an individual (or a group) with the identical test, after a certain period of time had elapsed since the original testing. There are several problems involved with stability measures in the assessment of creativity, however. These include:

(1) Determining whether creativity is, in fact, a stable, human characteristic. High test-retest reliability may be expected only when the researcher can be certain (theoretically or empirically) that the construct involved is actually stable in human behavior. Since certain theoretical formulations of creativity stress an irrational, preconscious, or emotional

Table 1

Needed Research Relating to the Validation of Creativity Measures

Area of Validation	Theoretical Problems	Methodological Problems	Research Needs
CONTENT VALIDITY	What is the universe from which we must sample? What do different measures attempt to sample? Is there one "creativity" or "many"? What is an adequate conceptual definition of "creativity"?	Are traditional psychometric procedures inappropriate? What new procedures can be used? What other aptitudes besides divergent thinking are involved in creativity? How can they be assessed? How can studies which employ different measures be compared" What constitutes an adequate operational definition of creativity?	1. Integration of theories and research literature. 2. More adequate conceptual and operational definitions. 3. Development of criteria for new measures of creative talent. 4. Development of new procedures for implementing those criteria.
CRITERION-RELATED VALIDITY (short-term or concurrent and long-term or predictive)	Selection of appropriate criteria Product-Process distinctions Generalization and moderator variables. Need for theoretical basis for predictions Identification of cognitive and affective components Novelty for whom? Need for long-term studies, wide sampling, more extensive criteria.	Criteria will probably be multiple-complex. Small selection of measures may be too limited to account for complex behavior. Establishing the validity and reliability of criteria. Inadequacy of teacher and peer judgments Diversity of tasks employed in literature Statistical problems in originality criteria.	1. Evaluation of validity and reliability of external criteria of creativity. 2. Long-term, multidimensional studies of creative abilities, personality, and behavior. 3. Need to conduct developmental and cross-cultural studies.

Continued

Table 1, Concluded

Area of Validation	Theoretical Problems	Methodological Problems	Research Needs
		Need for more extensive sampling and testing-spanning cognitive abilities, affective factors, behavioral indices. Developmental and cross-cultural differences unclear.	
ONSTRUCT ALIDITY	Need for extensive theory on which to base predictions and interpretations. Need to explain theoretical rationale for predictions and interpretations, and to distinguish creativity from other constructs. Need for integration and evaluation of extensive research literature Problems of definition, criteria, and selection of measures.	Theoretical and empirical distinction between creativity and other variables (particularly intelligence). Age differentiation; contrasts between high and low scoring groups. Convergent-Discriminant Validation Need for multivariate analyses, experimental and quasi-experimental studies, replication, and effective controls. Need for complex, long-term studies of creative behavior.	1. Multivariate research procedures applied to correlational problems. 2. Experimental and quasi-experimental studies of creativity, including adequate controls. 3. Replication studies 4. Long-term studies of creative behavior. 5. Extensive theoretical work, synthesis and evaluation of the literature, urgently needed.

component (e.g., Kubie, 1958; Gordon, 1961), it may not be possible to expect such stability in measures of creativity. To the extent that one is influenced by such theoretical orientation, it becomes irrelevant to inquire about test-retest reliability. Alternate views, however, such as Guilford's aptitude-approach, would place more emphasis on the stability of measures of creative abilities.

(2) Identifying an appropriate interval. It is clear that performance on an identical test may be influenced by factors other than the examinee's ability to respond to the test. One such factor involves the length of time or interval between test administrations. Tests administered too closely in proximity may be confounded by the subject's recall (or attempts to recall) previous responses. Too great an interval, however, may result in confounding effects produced by the intervening experiences or history of the subjects, or by maturation. Such problems may clearly inflate or inhibit the estimated stability of the test, and "open-ended" tests, such as those typically used in the assessment of creativity, may be particularly susceptible to such influences. No "ideal" interval can be specified, of course; it is clear, however, that any studies of the test-retest reliability of "creativity" measures must consider these problems, and, at least, state clearly the intervals employed.

(3) Motivational influences. As Torrance (1966) has pointed out, test-retest reliabilities in measures of creative

thinking may be influenced substantially by the motivational levels of the subject tested. Torrance concluded that researchers were often more adequate in their consideration of such motivational factors in experimental studies than when collecting normative data (1966, p. 22). This suggests that, in research on the measurement of creativity, such factors must be considered, manipulated, and, at very least, clearly described (cf., Elkind et al., 1970).

(4) Incomplete or partial sampling of the measurement universe. French and Michael (1966) propose that retesting is not a theoretically desirable approach to determining reliability when the test samples only one of many real or hypothetical sets of items which might have been used to assess the trait. In view of the complexity of the aptitudes and personality traits which may be involved in creative talent, and our tendency to employ only a limited sample of measures in most studies, this limitation appears to have considerable importance in the measurement of creativity.

A second general approach to determining the reliability of a test has to do with the "equivalence" or "comparability" of various forms of a test. Customarily, this approach to assessing the reliability of a test involves the administration of alternate forms of a test to the subject. If there are many tasks or items which might comprise a certain test, there is often no reason to assume that one particular sampling of that pool will yield a score which is systematically superior or

inferior to any other sampling of the same number of items from the same item pool. Thus, two "alternate forms" of the test should yield highly comparable scores.

Of course, in the measurement of creativity, we cannot be certain that a selection of a certain set of tasks represents a random and representative sample of some general "item pool." The great problem, then, in considering the use of alternate forms reliability, is to verify that the presumably alternate forms do, in fact, measure the same aptitudes; i.e., we must determine whether the two forms actually provide comparable measures of creative ability.

A third general approach to reliability, in which we are concerned with the internal consistency of a test, also provides problems for the creativity researcher. Measures of internal consistency (odd-even or other split-half measures, or the more general Kuder-Richardson formulas) generally assume that the subject's performance on one part of a test should not ordinarily be greatly different from his performance on another part. (Of course, the extent to which these assumptions are reasonable is related, in most reliability formulas, to the number of items, the time limits, and the sequence and difficulty of items.) Such measures may be entirely inappropriate, however, in the case of creativity measures which are open-ended, rather than comprised of discrete "items," and which are often selected, as Torrance (1966) argues, to represent a range of distinctly different abilities and performances.

It is not clear, then, that the traditional approaches to determining the reliability of a test are well-suited to the measurement of creativity. Except in the case of single-response, discrete-item tests (where validity may be doubtful against any complex criteria of creative talent), such measures may be difficult to employ, and may yield misleading data concerning the accuracy of measurement. Nevertheless, the general idea of determining the accuracy of reliability of creativity measures seems to have significance in evaluating research which must be conducted in this area.

There are, indeed, many factors which may influence creativity scores other than variations in creative abilities. Subjects' scores may be influenced by a variety of sampling errors; test administrators, raters, observers, or scorers; changes in the subjects' mood, motivation, or effort; or, variations in test content. It is important to know, and, as much as possible, to label clearly such "error variance" components in assessing creativity. French and Michael (1966, p. 26) refer to the estimation of clearly-labeled components of error variance as "the most informative outcome of a reliability study." Such efforts are clearly required in the development, utilization, and reporting of measures of creativity.

Usability

Although usability usually refers to several practical considerations in the selection and evaluation of a test, such as cost, availability, and supporting information or technical

manuals, it also subsumes several problems which relate to research on the measurement of creativity. Primarily, these problems are: test administration, test scoring, and norms.

Test Administration. Torrance (1972c) has reviewed several studies involving facilitating testing conditions among subjects from the first through the twelfth grades. Although Aliotti (1969) did not find significant differences among disadvantaged first graders' test scores as a result of movement and verbal warm-up activities the day prior to testing, many other studies have shown effects of similar treatments (Boersma and O'Bryan, 1968; Kogan and Morgan, 1969; Torrance, 1969; Mohan, 1970; Feldhusen et al., 1971; Khatena, 1971; Nash, 1971; Van Mondfrans et al., 1971). Christensen, Guilford, and Wilson (1957) also indicated that aptitude factors assessed in some divergent thinking measures were significantly influenced by working time and instructions. Although Wallach and Kogan (1965), Covington (in press) and others have objected to the use of carefully timed measures with test-like directions in assessing creativity, it does not appear that research has yet clarified systematically the effects of variations in such procedures (Treffinger, Renzulli, and Feldhusen, 1971). Until research is conducted in which specific predictions, derived from a theoretical interpretation of creativity, can be investigated, caution is advisable in manipulations of working time, instructions, and test administration procedures. Guilford (1971) also warns that, in research in which such manipulations are attempted, there should be

independent verification of the comparability or constancy of the aptitudes or abilities being tapped in each condition.

A related concern is the test environment. Hobson, Feldhusen, and Treffinger (1972) have presented evidence, for example, of the influence of verbal and pictorial mediators on divergent thinking test scores. Originality scores in conditions involving introduction of verbal mediators were significantly greater than in conditions involving introduction of pictorial mediators, although results concerning the time at which introducing mediators influenced scores were unclear.

Experience in administering tests of creative thinking or divergent production measures also suggests that some subjects clearly employ strategies of searching their surroundings for stimuli which might be useful as responses. In addition, in classroom testing, "seasonal" influences (Hallow'een, Thanksgiving, Christmas, etc.) are clearly found in children's test responses, whether because of a general set or because of the presence of specific topical stimuli in the classrooms. Yet we have not determined through research what factors condition these influences. Do such strategies reflect the efforts of the "most creative" subjects to respond and draw in every available resource? Or, alternatively, are these strategies employed by less creative subjects in an attempt to find some responses when none has been produced otherwise? Do such strategies perhaps tell less of the person's ability to think creatively than of his motivation or effort? Research should clearly be addressed

to these questions; in addition, researchers should be cautious to control and describe as carefully as possible the environment in which tests are administered.

In the previous section on reliability, the effects of motivation were considered briefly as an influence on the stability of creativity test scores. The role of motivation, and attempts to create facilitative testing conditions, also relate to our consideration of usability problems. Torrance (1972c) reviewed ten studies involving attempts to manipulate motivational variables to facilitate creative thinking. Research must be conducted, however, in which specific theoretical predictions are formulated and tested. In view of the variety of possible motivational influences that have been examined, and the large numbers of different criteria employed, it is difficult to assess whether motivational influences result in increased creative thinking by subjects or, alternatively, whether observed differences are merely situational artifacts of the testing conditions.

Test Scoring. The problem of test scoring is a very difficult one in the area of creativity. APA standards for psychological tests (French and Michael, 1966) indicate that, when subjective processes necessarily enter into the scoring of a test, evidence on the degree of agreement between independent scorings should be provided. In addition, it is recommended that the basis for scoring, and procedures for training scorers, should be described in detail in the test manual, to permit

other scorers to reach the same levels of agreement as in the studies reported in the manual. These standards should certainly apply to the development and use of measures of creativity. In addition, research in which measures of creativity are utilized should also report in detail evidence for the accuracy of scoring and agreement among scorers. This involves, of course, much more than the mere demonstration that scores assigned independently to the same tests by different scorers are highly intercorrelated, although such evidence is necessary. It also involves demonstrating that there are no systematic mean and variance discrepancies among the scorers, and that the scores assigned by all scorers are valid (i.e., tests were scored in agreement with the prescribed procedures for the instrument).

In addition, in view of the complexity of scoring "open-ended" measures of creative thinking, research should be conducted on two levels: first, on the development of new scoring procedures which will yield more accurate assessments of originality and imagination; and second, on ways to improve the accuracy of existing scoring procedures, such as through the utilization of natural language computing for the scoring of tests (Paulus and Renjulli, 1969).

Norms. The development of norms for use in the measurement of creativity represents another very difficult problem. Indeed, there are some who contend that, because of the very nature of creativity, it is impossible to develop or apply normative scoring procedures. In this view, the creative response is, by definition,

one which cannot be anticipated, one which represents essentially a departure from the ordinary. As such, it is impossible to specify in advance what kind of response will be considered creative. The initial problem in this view, of course, is that it seems to remove the potential for creative behavior from the domain of most persons, considering as "creative" only rare instances of exceptional or unusual accomplishment. In the present writer's view, it is more fruitful to consider creativity as an individual difference characteristic, suggesting that inter-individual variations in creative thinking are present (and predictable). Under such a view, in which every subject shares creative potential, although some will demonstrate greater potential or more exceptional actual performance than others, some distinctions among the responses of subjects can be classified and scored against normative criteria. Provision for the exceptional responses, unanticipated in the norms, must also be made, of course. This approach seems to be consistent with that employed in Torrance's assessment of Structure of Intellect aptitudes in creativity (1967).

Under this view, the problem is <u>not</u> whether there can be norms for scoring such variables as fluency, flexibility, originality, or elaboration. The question of interest to the researcher is: how can such norms most effectively be developed? A strong criticism of existing tests of creative thinking, in the present writer's view, is <u>not</u> their utilization of normative scoring criteria; it is that the norms used are frequently inadequate.

If normative scoring procedures are to be utilized, research must clarify: the population for which the norms are appropriate; specific predictions for variations in other populations; the differentiation of norms according to age, socioeconomic status, educational attainment, standing on other related cognitive or affective characteristics, or other relevant variables; and, the provision of adequate information for the standardization of test scores.

A related issue has to do with the selection and combination of sub-tests. In reviewing research which employs the Torrance Tests of Creative Thinking (1966), for example, one problem involves the fact that researchers frequently employ different samplings of sub-tests. This renders comparability of results across studies virtually impossible. In addition, some researchers report only undifferentiated total fluency, flexibility, originality, or elaboration scores; in some cases, it even appears that verbal and figural scores may not have been differentiated. Other studies have used total scores, derived from different groups of tasks, and some have utilized scores derived successively from single tasks. These variations among studies further reduce the comparability of test results. In addition, research by Harvey et al. (1970) suggests that the sub-tests or tasks selected by the researcher may substantially influence the nature of the abilities measured. In addition, Harvey et al. (1970) suggested that there may be some question about the extent to which scoring dimensions (fluency, flexibility, etc.) may accurately be combined across tasks.

Summary

The purpose of this paper was to identify several critical problems and areas of needed research on the measurement of creativity. The area was surveyed in three general categories: validity, reliability, and usability. In each of these areas, major problems and research needs included:

A. Validity

1. There is a substantial need for extensive theoretical work in the field of creativity, as well as for synthesis, integration, and evaluation of the research literature.

2. Progress in developing adequate operational definitions of creativity depends greatly on progress in developing adequate conceptual definitions.

3. There is a need for extensive studies of new, more adequate external criteria for the validation of creativity measures, as well as for inquiry into the validity and reliability of existing criteria.

4. There is a need for multivariate methods to be employed in correlational studies of creative talent.

5. There are needs for longitudinal studies, well-controlled experimental studies, replications, and for developmental and cross-cultural studies.

B. Reliability

1. Studies are needed which investigate new methods of determining the accuracy or reliability of measures of creativity,

with emphasis on the specification of "error" components more comprehensively.

2. In employing traditional stability indices, attention must be given to determining the extent to which creativity should be expected to be a stable trait, in identifying appropriate intervals for assessing stability, and for assessing systematically the influence of motivation, moods, and other situational variables on reliability of test scores.

3. In considering the utilization of alternate forms or internal consistency indices of reliability, attention must be given to the problems involved in selection and use of subtests from larger batteries. It must be recognized that tasks in creativity tests may not be discrete "items," and that scores derived from various tasks may neither be additive, nor meet many fundamental assumptions involved in the traditional determination of reliability indices.

C. Usability

1. Research must be addressed to developing a systematic theoretical and empirical understanding of the effects of variations in test administration procedures and conditions (including directions, testing environment, working time, and response modes.)

2. Problems relating to test scoring are very important in the measurement of creativity. In addition to research on the comparability of scores derived from different tasks and different methods of testing, studies should also be conducted

which investigate new methods and criteria for scoring (particularly for originality and "imagination."

3. Problems of the validity and reliability of scorers are extremely important, and all research employing creativity measures should provide full information concerning inter-scorer correlations, as well as comparison of means and variances among scorers and between scorers and test norms.

4. Creativity measures which involve normative scoring procedures must be accompanied by extensive supporting data concerning the norm groups employed and the tasks involved.

These problems are very complex, and may not soon be resolved. It seems necessary to recognize them, however, and to take into account such problems in the interpretation of research in which "creativity" measures are used. It would also be of significant value to researchers in the psychological study of creativity if support were increased for research in these areas.

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APPENDIX

Outline for PEM Study Adopted for Planning Purposes

(Detailed changes have been made by Task Groups at the discretion of group members.)

1000. PEM Aspects of Child Development

1100. Special Problems in Infancy and Early Childhood (birth to 5 years)

1101. Group care
   1. Effects of orphanage rearing, multiple mothering vs one-to-one mother-child (or surrogate mother) relations
   2. Related effects of environmental complexity

1102. Separation anxiety: fear of the strange

1103. Readiness
   1. General concept
   2. Special application to disadvantaged children

1104. Forced training ("pushing")
   1. In relation to "natural" intellectual limits
   2. In relation to readiness

1105. Sequential organization of learning
   1. In infancy
   2. In early childhood

1106. Parental involvement and influence on early development
   1. Effects of home environment, of implicit theories and practices of parents
   2. Manipulation of parental beliefs and practices, in enrichment programs

1107. Modes of learning and experience that affect early behavioral development
   1. Differential effects on anatomical maturation and behavioral development
   2. Correspondence between rates of anatomical and behavioral development
   3. Effects of environmental (experiential) enrichment and impoverishment, and cumulative effects with increasingly complex circumstances
   4. Hierarchical conceptions of intellectual development (Piaget)
   5. Development of learning sets and their implications for intellectual, motivational, and personality development; resistance of resultant behaviors to extinction
   6. Critical periods

1200. Child Socialization

1201. Conceptualization of the socialization process
   1. Socialization pressures
   2. Learning paradigms: e.g., dependency relations and adult control of "effects" (reinforcement), reference group formation

1202. Internalization of beliefs and values
   1. Conceptualization of attitude, belief, and value systems
   2. Identification processes
   3. Impulse control (self control)
   4. Effects of environmental resources

1203. Cognitive socialization
   1. Psycholinguistic structures, language development: effects on thought, beliefs, attitudes, interests; patterns of expression, values
   2. Uncertainty and information-seeking
   3. Development of expectancies; category accessibility; assimilation; effects on perception, cognition, action
   4. Symbolism, symbolic behavior

1300. Personality Development

1301. Developmental theories (Freud, Erikson, Piaget, Sears)

1302. Developmental sequences, stages
   1. Critical periods
   2. Fluid and crystallized patterns of intelligence (Cattell)

1303. Development of self-identity
   1. Self concept, ego theories, self theories
   2. Relations to social class, racial-ethnic factors, region, sex, family characteristics

1304. Effects of age, sex, culture, and other environmental factors

1305. Development of mechanisms of coping and adaptation

1400. Behavior Change

1401. Personality, learning

1402. Susceptibility to change of personality traits, attitudes, interests, beliefs, values

1403. Measurement of change

1404. Genetic, maturation, and learning factors in physical and psychological growth

2000. Personality

2100. Conceptual and Theoretical Approaches

2101. Criteria for a viable theory

2102. Development of unified, integrated theoretical formulations
   1. Cross-level comparisons and correlations
   2. Developmental histories of stable traits
   3. Relations among trait patterns at various developmental levels
   4. Relations of traits to perceptual responses in person perception and interpersonal interaction

2200. Cognitive Conceptions

2201. Cognitive style, complexity
2202. Balance theories
2203. Cybernetic formulations
    1. Computer simulation of personality
    2. Mathematical models

2300. Developmental Approaches (see 1300)

2400. Dynamic Approaches (see 1303, 4000)

2500. Morphologic Approaches

2600. Physiologic, Psychophysiological, and Biochemical Approaches (see 2102.1)

2700. Trait Structure, Multivariate Approach - Taxonomy of Trait-Explanatory Concepts of Stylistic and Temperament Aspects of Personality
2701. Methodological problems: definition of universes of behaviors for self-report, observation-rating, and objective test studies, cross-media matching of stable structures, design paradigms, including multi-modality designs and trait x treatment designs; construct validation of traits; effects of age, sex, sample, culture, and other environmental effects, and relations of these to resulting trait patterns; the range of roles and sets in relation to diversity of response patterns obtained (social desirability, acquiescence, and other specific sets), their similarities in terms of effects on self-description, and the relations of traits to moderator variables representing such sets
2702. Observational, rating methods: rater and "ratee" sources of effects in peer and "other" ratings, in observational trait assessment, and in interpersonal interaction; explicit concern with task, stimulus presentation, response format, socio-environmental setting, and demographic characteristics of participants; conceptual and empirical relationships among similar and related trait descriptors within observational-rating subdomain and in other subdomains (self-report)
2703. Self-report methods: item pools; format; item vs cluster factorization; measurement of and correction for response bias or distortion; development of a unified, consistent conceptual framework for concepts of personality style and temperament
2704. Objective test, misperceptive, indirect assessment, and development of fresh, new approaches to personality measurement and description

2800. Creativity
2801. Conceptualization of creativity; relations to intelligence, personality factors

2802. Characteristics of the creative person
2803. Analysis of the creative process
2804. Characteristics of the creative product
2805. Characteristics of the creative situation, short- and long-term; situational factors contributing to creative performance
2806. Measurement of creativity

3000. Emotions

3100. State Patterns: Physiological, Cognitive, Behavioral
3101. Arousal stimuli
3102. Response dimensions
3103. Uniqueness
3104. Learned-unlearned dimensions
3105. Affective learning; autonomic and physiological learning

3200. Relations to Traits, Roles

3300. Moderation of Expression by Learning
1. Culture patterns
2. Age, sex, group norms

3400. Drug Effects on Emotional Patterns

3500. Differentiation of States, Reflecting Situational, Organismic, and Stimulus Variations, from Traits, Represented as Long-Term Individual Dispositions

3600. Arousal States: Adrenergic Response, Stress

3700. Dysphoric States: Anxiety, Depression, Guilt, Shame, Remorse (see 4300)

3800. Duphoric States: Happiness, Elation, Joy, Hope, Confidence

4000. Motivation

4100. Conceptualization and Theory (human motivation)
4101. Homeostatic systems, physiological need
4102. Need-press system (Murray), subsystems (n Ach)
4103. Dynamic systems (Freud, Cattell)
4104. Cognitive and cybernetic approaches: motivation inherent in information-processing functions (Hunt), cognitive dissonance theory, incongruity, collative variables (Berlyne), balance theories, exchange theory
4105. Motivation inherent in individual performance, competence motivation (White)
4106. Trait systems and patterns (Guilford, Cattell)
4107. Values systems, moral character
4108. Conceptualization of interest, attitude, need, belief, value, ideal

4200. Process and Trait Formulations
4201. Relations and differences in conception and approach
4202. Process theories and formulations
  1. Balance theories
  2. Exchange theory
4203. Trait formulations: motives, values, character traits
  1. Methodology of measurement: Strong paradigm, Thurstone scales, Likert scales, Cattell's and Campbell's indirect approaches: self-report, objective, misperception, observation, rating, content analysis, unobtrusive measures
  2. Analytic approaches: factor analysis, multidimensional scaling, profile clustering
  3. Factored patterns of sentiments, attitudes, interests, beliefs, values
  4. Variations related to age, sex, sample, culture, and other environmental factors

4300. Frustration, Stress, and Anxiety
4301. Frustration theory and research evidence
4302. Conceptualization of stress
  1. Relation to frustration (Selye)
  2. Utility of stress concept in interpretation of behavior
  3. Relationships among physiological and psychological aspects
  4. Stress and coping, adaptation
4303. Adaptation-Level Theory (Helson) (see 5100)

4400. Conflict
4401. Conceptualization of conflict (Miller, Murphy, Cattell)
  1. Types of conflict: role, value, internal
  2. Approach and avoidance relations
4402. Conflict measurement and calculus
4403. Conflict in relation to interpretation and prediction of action

4500. Interests and Vocational Guidance
4501. Incremental value of interest measurement over ability and aptitude measures in predictions of various criteria on various populations (Thorndike, 10,000 Occupations; Clark, Minnesota study)

5000. Environmental Variables

5100. Conceptualization of Environmental Variables and Their Effects on Behavior; Human Ecology

5200. Methodologies for Encoding Environmental Factors

5300. Taxonomic Systems of Environmental Variables

5400. Normative Studies of Selected Behaviors in Relation to Defined Patterns of Environmental Setting: Sampling Problems in Relation to Populations, Behaviors, Macro- and Micro-Environmental Settings

6000. Interpersonal Behavior Processes

6100. Group Theory, Role Theory, Interpersonal Settings

6200. Interpersonal Perception, Attraction, Influence; Social Acuity, Empathy

7000. Variations in Psychological Processes

7100. Paradigms for such Research, Taking Account of Persons, Tasks, Environmental Settings, and Occasions (Cattell covariation chart, Campbell-Fiske model, longitudinal replication)

7200. Paradigmatic Studies of Selected Learning, Motivation, Perception, and Other Psychological Processes to Investigate Variations Attributable to Shifts in Subject, Task, Setting, and Occasion Dimensions

7201. Analyses to estimate magnitudes of variance components in standard dependent variables accounted for by trait, treatment, and trait by treatment sources and their specific constituents

7202. Analysis of total interaction parameter estimates into principal components or other dimensions in order to compare results by such methods with conventional R, P, Q analysis, both with single dependent variables and vectors (multiple dependent variables)